1967

CADILLAC

SHOP MANUAL

CHP-646701

1967 CADILLAC SHOP MANUAL

Service information pertaining only to those features that are exclusive to the Fleetwood Eldorado is provided at the back of the individual sections in this manual. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as described in the forward portion of the individual sections.

Service Department
CADILLAC MOTOR CAR DIVISION
General Motors Corporation
Detroit, Michigan

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GENERAL INFORMATION, MAINTENANCE AND LUBRICATION

Foreword

This Shop Manual has been prepared by the Service Department of the Cadillac Motor Car Division to aid in servicing 1967 model Cadillac automobiles. It is intended primarily for Servicemen who are familiar with earlier model Cadillacs. It includes complete information on service procedures and specifications pertaining to all 1967 model Cadillac cars.

Arrangement of the Manual

The front page contains a rapid reference section index with headings corresponding to the page tabs at the beginning of each section. A Table of Contents is provided at the beginning of each section that contains more than one major subject. A complete alphabetical index is located at the back of the manual.

The section sequence used in this manual has been arranged to conform with the Universal Parts Classification (U.P.C.) grouping adopted by General Motors Corporation. This sequence will enable service personnel of dual dealerships to locate information in technical and parts manuals more easily.

The individual sections include a general description of components, service adjustments and replacement procedures, diagnostic information, and identifiable illustrations. An illustrated list of special tools, a torque requirement chart, and specifications are also provided.

Service information pertaining only to those features that are exclusive with the Fleetwood Eldorado, is provided at the back of the individual sections in the manual. For service procedures and recommendations not listed, refer to the forward part of the appropriate section, as these service procedures are similar to those on standard cars.

GENERAL INFORMATION

Body Style Number

Four standard series of cars with 12 body styles are included in the 1967 Cadillac line. In addition, there is a Commercial Chassis. The numeral six is used as the first digit in designating all 1967 Cadillac body style numbers. The first three digits of the body style number indicate the series designation, the last two digits indicate the body style. Specifications are shown on Page 0-3.

Vehicle Identification Number

Each Cadillac automobile or chassis carries a Vehicle Identification Number. The number is used in license and insurance applications and in general reference to the automobile. The letter indicates the sales code, the first digit of the number indicates the model year, and the last six digits indicate the sequence in which the car was built (see Page 0-3). The last six digits of the first 1967 Cadillac automobile manufactured is number 100001, regardless of series or style; subsequent cars built are numbered in numerical order. On engines built to low compression specifications, the letters L.C. are stamped on the engine block just below the head surface at the rear of the left cylinder bank. Vehicle Identification Number locations are shown in Fig. 0-1.

Identification Numbers

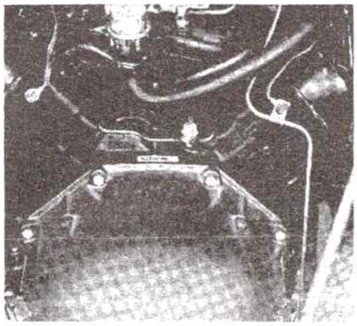
Locations of identification numbers on various units are shown in Fig. 0-1. The identification number on the unit should always appear on forms sent to the Central Office such as PIR's, Claims Tags, Pre-Delivery Reports and, when required, on AFA's. The Vehicle Identification Number, and the transmission unit number are particularly important when reporting product information on these components.

Body Name Plate

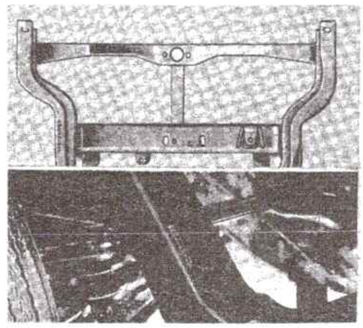
A body name plate, Fig. 0-2, is attached to the top surface of the shroud at the left, under the hood, near the cowl. The name plate carries the style number, trim number, body number and paint number in the areas indicated by ST, TR, BODY and PAINT.

The first two digits of the paint number indicate color of the body shell and chassis sheet metal; the next two digits indicate color of convertible and fabric tops.

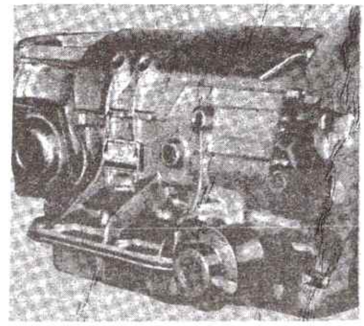
The number-letter code at the upper left indicates date of assembly (month-week) and the letter code at the bottom indicates accessory equipment installed in production.



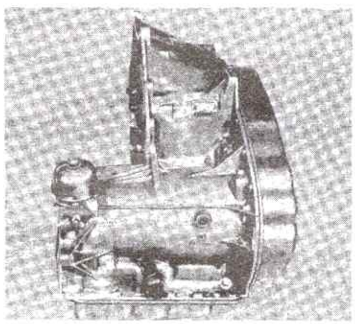
VEHICLE IDENTIFICATION NUMBER LOCATED ON REAR PORTION OF CRANKCASE BEHIND INTAKE MANIFOLD.



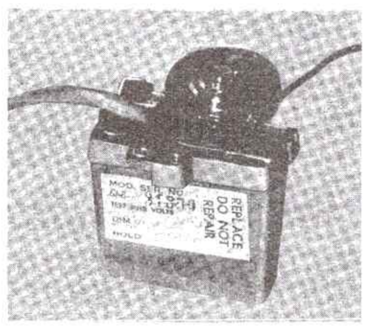
VEHICLE IDENTIFICATION NUMBER LOCATED ON LEFT FRAME SIDE RAIL OF 693 CARS AND ON RIGHT FRAME SIDE RAIL OF ALL OTHER CARS.



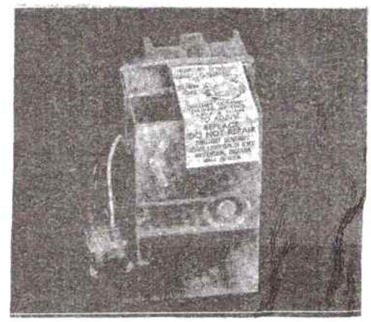
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON RIGHT SIDE OF CASE (EXCEPT 693).



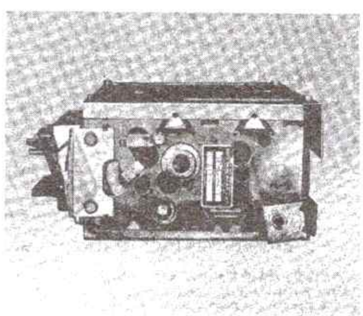
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON LEFT SIDE OF CONVERTER HOUSING (693 ONLY).



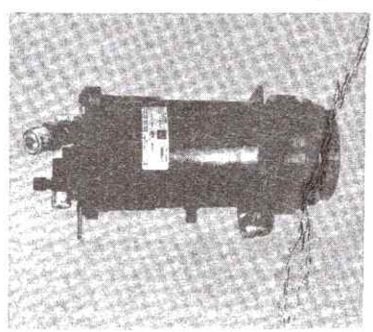
GUIDE-MATIC PHOTOTUBE AND AMPLIFIER SERIAL NUMBER LABEL LOCATED ON TOP OF UNIT.



TWILIGHT SENTINEL AMPLIFIER SERIAL NUMBER LABEL LOCATED ON COVER OF UNIT.



RADIO SERIAL NUMBER TAG LOCATED ON RIGHT SIDE OF TUNER.



A/C COMPRESSOR SERIAL NUMBER LABEL LOCATED ON REAR PORTION OF COMPRESSOR HOUSING.

Fig. 0-1 Unit Number Locations

GENERAL DESCRIPTION AND SPECIFICATIONS

Description	Style Number	Sales Code	Vehicle Identification Number	Wheelbase (Inches)	Overall Length (Inches)	Overall Height (Inches)	Maximum Width (Inches)
Fleetwood Sixty Special Sedan	68069	M	M7100001	133.0	227.5	56.7	80.0
Fleetwood Brougham Sedan	68169	P	P7100001	133.0	227.5	56.8	80.0
Calais Hardtop Sedan	68249	N	N7100001	129.5	224.0	54.5	80.0
Calais Coupe	68247	G	G7100001	129.5	224.0	54.6	80.0
Calais Sedan	68269	K	K7100001	129.5	224.0	55.6	80.0
Hardtop Sedan de Ville	68349	B	B7100001	129.5	224.0	54.5	80.0
Coupe de Ville	68347	J	J7100001	129.5	224.0	54.6	80.0
De Ville Convertible	68367	F	F7100001	129.5	224.0	54.3	80.0
Sedan de Ville	68369	L	L7100001	129.5	224.0	55.6	80.0
Fleetwood Eldorado	69347	H	H7100001	120.0	221.0	53.3	80.0
Fleetwood Seventy-Five Sedan	69723	R	R7100001	149.8	244.3	57.4	80.0
Fleetwood Seventy-Five Limousine	69733	S	S7100001	149.8	244.3	57.4	80.0
Commercial Chassis	69890	Z	Z7100001	156.0	249.5	--	--

Keys and Locks

All 1967 model Cadillac cars are equipped with a new five bitting level lock cylinder and key. Five bitting levels are used to form one of 2,000 possible combinations.

Two non-interchangeable keyways are used. One keyway, known as the "A" type, is used in ignition and door lock cylinders. The second keyway, known as the "B" type is used in the glove compartment, console compartment and rear compartment lock cylinders.

To fit these lock cylinders, two keys are required. The ignition and door lock key for these five level lock cylinders may be identified by a small capital "A" stamped on one side of the key. The "A" type key has a hexagonal head. A second key is used for the glove, console, and rear compartment locks. This key has a round head and may be identified by a small capital "B" stamped on one side. These marks serve to distinguish the keys for five level locks from those used in previous years.

On Limousine styles, a separate key is provided for the lock on the right hand door of the rear passenger compartment. The key is different from the one used for the ignition switch and left front doors. The octagonal key is notched on two sides for easy identification.

Because of the way in which the key blade is grooved, each key will fit only the type of lock it is to be used in Keys used in Cadillac locks of previous years will not enter the keyway of these new locks.

For service replacement keys, see Note a.

Key code numbers are stamped on the "knock-out" plug in the key head. After the code has been recorded by the owner to facilitate replacements or duplications of a key, the plugs should be knocked out of the key heads. If key code numbers are not available from records or from the "knock-out" plug, the code can be determined by laying the key on the diagram in Fig. 0-3, or from the door and rear compartment lock assemblies themselves.

For "A" type lock cylinder assemblies, the key code number is stamped on the side of the door

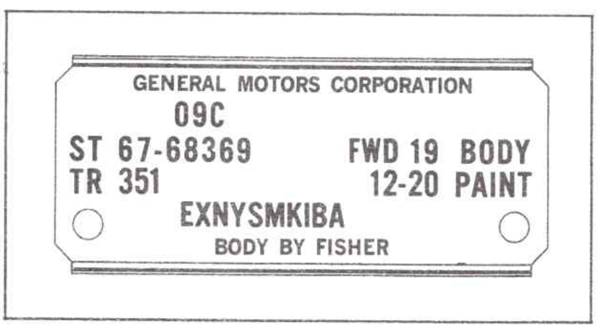


Fig. 0-2 Body Name Plate

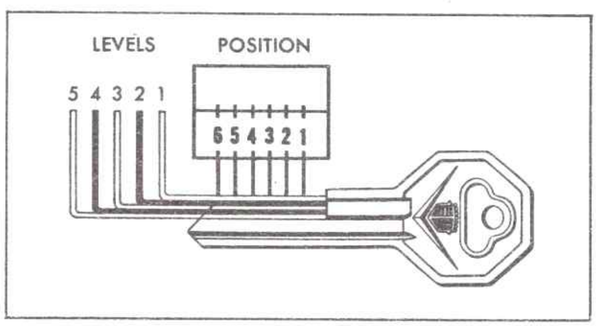


Fig. 0-3 Key Code Diagram

lock cylinder case; for "B" type lock cylinder assemblies, the number is stamped on the side of the rear compartment lock cylinder. From these numbers the lock cimbination can be determined by use of a code list for cutting new keys or coding a replacement service lock cylinder assembly. Ignition, glove compartment and console lock cylinders coded by the car division do not have key code numbers stamped on them; therefore, codes may be determined either from a door or rear compartment lock cylinder of the same car which will have the same lock tumblers, or from the key code diagram, Fig. 0-3.

a. Cutting Keys

After the special code has been determined, either from the code list or the Key Code Diagram, Fig. 0-3, cut a blank key to the proper level for each of the six tumbler positions, and check the key in the lock cylinder. The new key should agree with the combination opposite the code number in the code list.

b. Assembling Lock Cylinders

New lock cylinders for duplicating any lock are available from your servicing Parts Warehouse with the lock cylinder and locking bar staked in place, less tumblers. Tumblers are also available and must be assembled into the cylinder according to the following special code.

When it is necessary to assemble a new lock cylinder to agree with a key code number, install the proper tumblers into their respective slots, as inciated by Key Code Diagram, Fig. 0-3 or Briggs and Stratton Code List.

Tumblers are all locks except the glove and console compartments are shaped exactly alike, with the exception of the position of a notch on one side. Tumblers for glove and console lock cylinders are different and will not interchange with any other lock tumblers. As the key is inserted in the lock cylinder, the tumblers are raised to the correct height so that the notches on each tumbler are on the same level. When the notches on all six tumblers line up, the locking bar is pushed into the notches by two small springs, allowing the cylinder to turn in its bore. Five types of tumblers are used to make all the various lock tumbler combinations and each is coded according to a number, 1 through 5, stamped on its side. Refer to Note c to assemble all lock cylinders except the glove and console locks.

Only one type of tumbler is used to make the various lock tumbler combinations for glove and console compartment locks. Tumblers for these two lock cylinders are of a different design than the tumblers used in all other lock cylinders.

As the key is inserted in the lock cylinder, each tumbler is depressed so that no part of any tumbler is exposed above the level of the lock cylinder allowing the cylinder to turn in its bore. Refer to Note d to assemble glove and console compartment lock cylinders.

To determine which tumblers should be installed in what position for a given key, when a code list is not available, proceed as follows:

1. Lay the key on the Key Code Diagram, Fig. 0-3, with the key outlined by the diagram as accurately as possible.

2. Starting at the base of the key blade, determine the lowest level that is visible in position #1.

3. Determine the lowest visible level for the remaining five positions. As each tumbler level is determined, write that number in the blank space provided above the position numbers.

4. Cuts that fall in the first white section, mark Level #1 on top of appropriate position number.

5. Cuts that fall in the first black section, mark #2 on top of appropriate position number.

6. Cuts that fall in the second white section, mark #3 on top of appropriate position number.

7. Cuts that fall in the second black section, mark #4 on top of appropriate position number.

8. Cuts that fall in the third white section, mark #5 on top of appropriate position number.

c. Assembling Lock Cylinders (Except Glove and Console Compartments)

After the tumbler arrangement has been determined as shown in Note b, ignition and door lock cylinders should be assembled as follows:

1. Hold cylinder with head of cylinder away and starting at the head of the cylinder, insert the tumblers in their proper slots in the order called for by the code, ribbed side toward you and long point down.

2. Insert one tumbler spring in the space provided above each tumbler.

CAUTION: If the springs become tangled, do not pull them apart -- unscrew them.

3. Reverse the lock cylinder so that the head of the cylinder is now toward you. Insert the spring retainer so that the two end prongs slide into the slots at either end of the cylinder. Press the retainer down.

4. To check, insert proper key and if tumblers are installed properly the side bar will be allowed

to drop down. If bar does not drop down, remove the key, spring retainer, springs and tumblers and reassemble correctly.

NOTE: If the tumblers have not been assembled correctly, they can be removed from the cylinder by holding it with the tumbler slots down, pulling the locking bar out with the fingers and jarring the cylinder to shake the tumblers out. This procedure is necessary because once the tumblers have been pressed down into the cylinder they are held in their slots by the locking bar.

5. If, after checking, it is found that the lock is assembled properly, remove key and secure cylinder in a vise with spring retainer exposed. Use leather or wood at each vice jaw to prevent damage to the cylinder.

6. Stake the retainer securely in place by staking the cylinder metal over both edges at each retainer end using a suitable staking tool at right angles to the top of the retainer.

d. Assembling Glove and Console Compartment Lock Cylinders

NOTE: These two lock assemblies require four tumblers rather than six required in other locks. Tumblers for positions 3-4-5-6 should be installed. Do not install tumblers which correspond to positions 1 and 2 on the key. The black "tumbler" that is closest to the head of the lock cylinder is a locking device and should not be removed unless damaged.

1. Insert tumbler spring in space provided at side of first tumbler. Install tumbler in position.

2. Repeat Step #1 for remaining three tumblers.

3. Press tumblers down as far as possible and insert key in cylinder with tumblers in this position.

4. Place cylinder in a vise using leather or wood at each vise jaw to prevent damage to the cylinder.

5. File tumblers down so that no part of any tumbler extends above the lock cylinder. A standard 5/8" double cut bastard file is recommended for this operation. To finish the job, use a flat 5-1/2" #2 cut needle equalling file.

NOTE: Do not file any part of black "tumbler" in position #2. This is a locking bar and should not be altered.

6. Reverse lock cylinder position in vice and repeat step #5 for bottom of tumblers.

7. Install a retainer wire in the groove on each side of the tumblers and stake the retainer wires in place.

Towing Instructions (Except 693 Style)

1967 Cadillac cars cannot be started by pushing, and this procedure should never be attempted. If the car cannot be started in the normal manner, or by the use of jumper cables, it should be towed to the nearest authorized Cadillac service facility.

If the transmission, drive line, or axle do not have a malfunction, the vehicle may be towed in Neutral "N" at speeds up to 35 MPH for distances up to 50 miles. For higher speeds or extended distances, it is recommended that the propeller shaft be disconnected or rear wheels be off the ground.

If towing requires raising front or rear of car, wheels should be lifted just slightly off the ground. When towing with rear wheels raised, tie down steering wheel with front wheels in straight ahead position.

Before towing, check transmission fluid level. Fluid level must be above full mark on the dip stick with engine "off." Always tow car with transmission shift lever in Neutral position.

Towing Instructions (693 Style Only)

The 1967 Fleetwood Eldorado cannot be started by pushing and this procedure should never be attempted. If the car cannot be started in the normal manner, or with the aid of jumper cables, it should be towed to the nearest authorized Cadillac service facility.

It is recommended that the car be towed with the front wheels off the ground. In case vehicle damage in the rear wheel area will not permit towing with the front wheels raised, the car can be towed with the rear wheels off the ground. If towing requires raising the rear of the car, the wheels should be raised just slightly off the ground and the steering wheel should be secured with front wheels in straight ahead position. Always place the transmission shift lever in Neutral "N" position when towing the car with the rear wheels off the ground. The car can be towed at speeds up to 35 MPH for distances up to 50 miles.

Car Storage Preparation

Certain precautions must be taken when placing a car in "dead" storage for extended periods of time. Listed below are the recommendations to be followed when storing a car for 30 days or less, and for a period of 30 days to 12 months.

a. Car Storage Preparation—30 Days or Less

1. Wash car and inflate tires to 40 pounds pressure.

2. Provide proper cooling system protection.

3. Run engine until completely warmed up; then drain and refill with fresh oil which, according to the label on the can is: (1) intended for service "MS" and (2) passes car makers' tests or meets General Motors Standard GM 4745-M.

4. Run engine again with fresh oil until completely warmed up; drive car to place of storage and park. Do not restart again until end of storage period.

5. Be sure parking brake is in released position and car is on level surface.

6. If car is to be stored in a hot area, the fuel tank, lines, pump, filter and carburetor should be drained.

7. Disconnect battery and prevent battery from discharging or freezing.

b. Car Storage Preparation—30 Days to 12 Months

1. Wash car.

2. Run engine until completely warmed up; then drain and refill with fresh oil which according to the label on the can is: (1) intended for service "MS," and (2) passes car makers' tests or meets General Motors Standard "GM 4745-M".

3. Run engine again with fresh oil until completely warmed up; drive car to storage area. Run engine at 2,000 rpm in neutral and pour engine oil into carburetor. After about a pint has been added, pour oil fast enough to stall engine.

4. Be sure parking brake is in released position and car is on level surface.

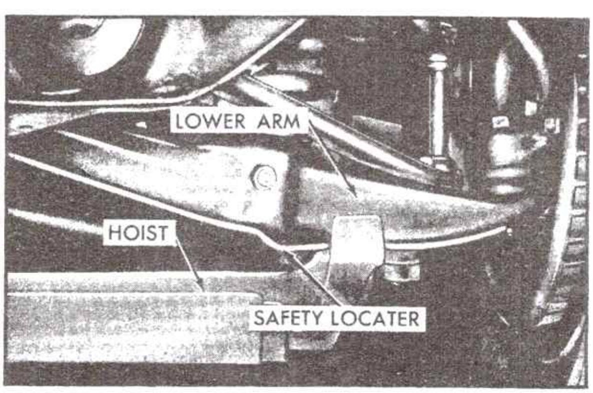


Fig. 0-4 Positioning Car on Hoist

5. Drain gasoline from fuel tank.

6. Disconnect all fuel lines, blow out, and reconnect.

7. Remove carburetor, clean thoroughly, and store in plastic bag.

8. Remove fuel pump, clean, and store with carburetor. Remove filter assembly, discard element, clean and store with fuel pump and carburetor.

NOTE: Tape fuel pump, carburetor and gas line openings closed with masking tape.

9. Drain coolant from radiator, cylinder block and heater cores.

10. Lower windows 1/2 inch to stop humidity "sweat" and mold.

11. Remove battery from car, and have charge maintained during period car is stored.

12. Put car up on chassis stands so that tires are off the floor.

13. Apply 10 W engine oil to exterior bright surfaces.

14. When car is taken out of storage, install a new fuel filter element, check brake system for leaks, and bleed brakes. Clean spark plugs and regap.

Of these recommendations, proper cooling system protection, and refraining from starting the engine and running it for short periods during the storage interval, should be considered most important. Running the engine in this manner would cause crankcase condensation and possible acid contamination of the oil. A car should never be stored with used oil in the crankcase.

Special consideration should be given when conditions of high humidity, high temperature, or outdoor storage are encountered. Local experience will dictate the additional protection measures in each particular case.

Hoist Recommendations (Except 693 Style)

The preferred type of hoist for lifting all 1967 Cadillac cars is one that engages the front suspension and rear axle, or all four wheels.

The front lower suspension arm is designed to provide a flattened portion on the flange of the arm for use with lifting equipment that engages the suspension system. When using lifting equipment of this type, make certain that the car is properly centered over the hoist and that the hoist

arms are positioned under the flattened portion of the flange, Fig. 0-4, outboard of the safety locaters. If the hoist arms are not properly positioned in relation to the lower support arms, the car may shift on the hoist.

If a frame-engaging hoist is used, certain precautions must be observed. The shaded areas, Fig. 0-5, indicate the only acceptable positions for lift pads. Pads must be used in these areas with maximum surface contact and must not contact any part of the frame not indicated.

Do not use a frame-engaging hoist to raise the Fleetwood Seventy-Five sedan and limousine or the commercial chassis.

CAUTION: The shock absorbers act as rebound stops for the rear suspension. Under no circumstances should the rear end of car be raised so that rear suspension is in rebound position while disconnecting shock absorbers.

Hoist Recommendations (693 Style Only)

The preferred type of hoist for lifting the 1967 Fleetwood Eldorado is one that engages the front suspension and rear axle or all four wheels.

CAUTION: When raising the car on a suspension type hoist, a special adapter may be required on some type hoists to prevent damage to the rear axle as the center line of the rear axle is behind the center line of the rear wheels.

If a frame-engaging hoist is used, hoist lift pads must be positioned under the frame as shown by the shaded areas in Fig. 0-6. When car is positioned on hoist in this manner, the center line of the door is behind the center line of the lift post for proper weight distribution.

If a drive-on hoist is used, be sure the center line relationship as stated above is also applied (Fig. 0-6).

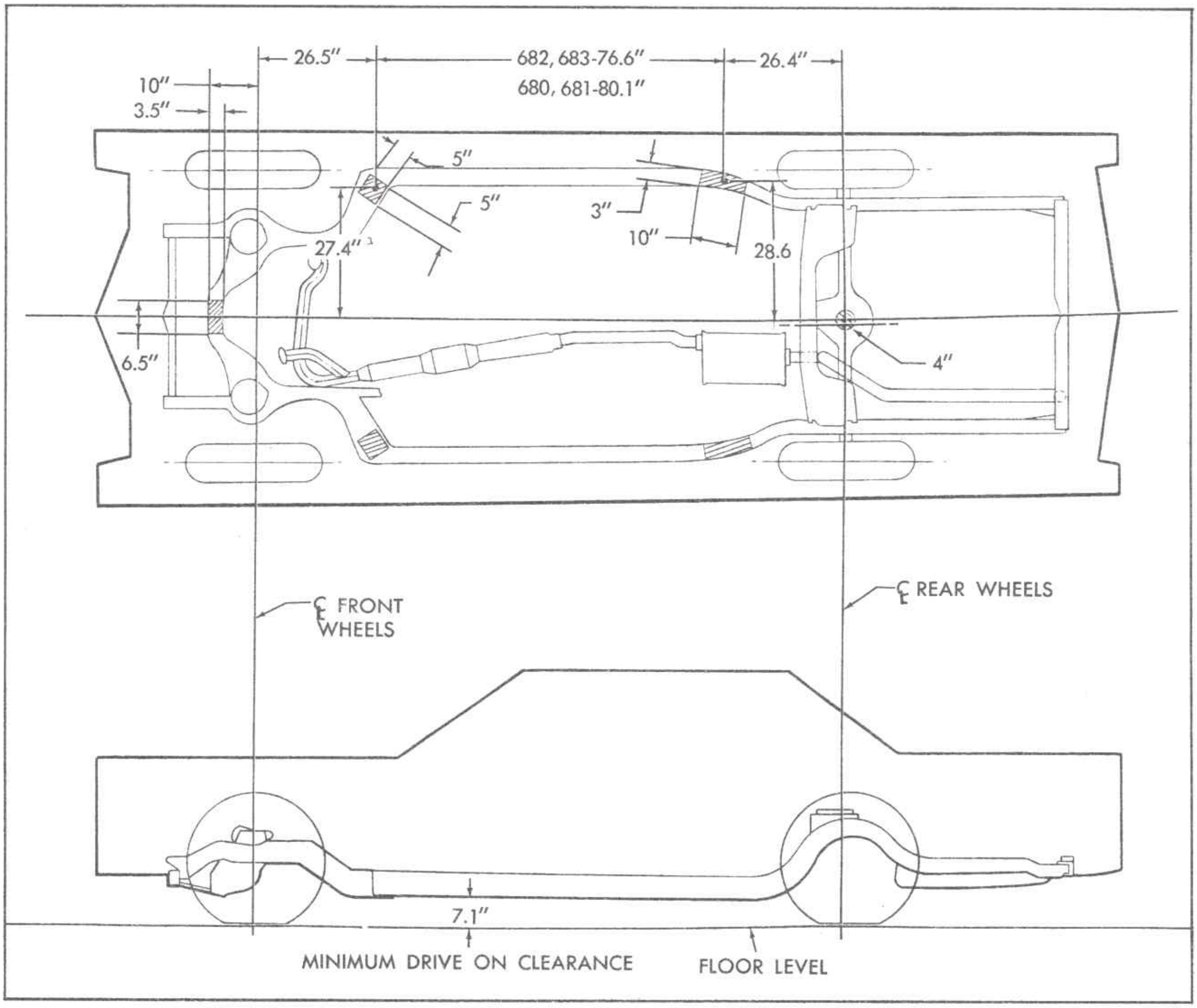


Fig. 0-5 Hoist Position (Except 693)

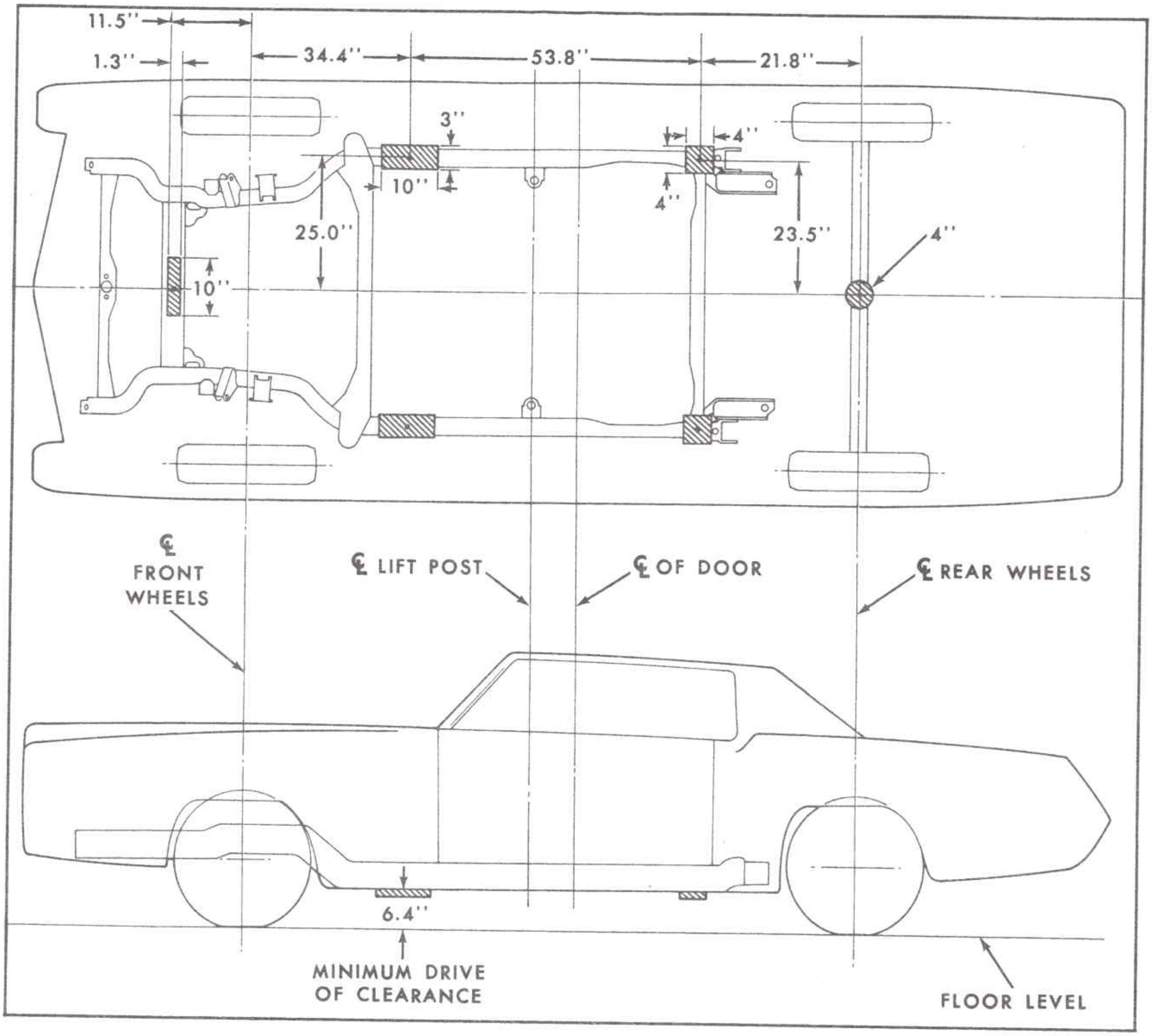


Fig. 0-6 Hoist Position (693)

When supporting the Fleetwood Eldorado with a floor jack or jack stands, the supports should be placed at the suspension lift points or the frame contact lift points. The Fleetwood Eldorado should never be supported at the extreme ends of the frame or at the center of the frame side rail or lifted at the front or rear bumper with anything other than the bumper jack provided with the car.

Lubrication Information

Complete instructions for lubrication of the various points of the 1967 Cadillac car are described under Service Information in this section. An Engine Oil Change Interval and Viscosity Chart, and a Fluid Capacity Chart appear at the end of this section.

The Maintenance Schedule, Page 0-20, is based upon service at time of engine oil change, unless otherwise specified. The recommended engine oil change interval, regardless of season, is every 60 days, never to exceed 6,000 miles.

More frequent changes are required with stop and go operation, prolonged idling periods, dusty road travel, or during extended cold or wet climatic conditions. In such cases, an oil change is recommended after 2,000 or even 1,000 miles of driving.

The front suspension spherical joints do not require periodic maintenance. The seals, however, should be inspected for physical damage or cracks each time the engine oil is changed. If this inspection is neglected, water and dirt may enter the joint through a leaking seal and cause the joint to become noisy. It will then be necessary to replace the seal and repack the joint.

The inner and outer tie rod pivot spherical joint

seals should also be inspected for physical damage each time the engine oil is changed. In addition all other steering linkage joints should be checked for looseness or damage. In the event a joint is found to be loose, the affected inner or outer tie rod pivot or linkage joint should be replaced. If damaged inner or outer tie rod pivot seals are found on 693 series cars, the seal may be replaced and the joint repacked as described in section 9, note 28.

A Service Notice plate, Fig. 0-7, is attached to the front face of the left door lock pillar. The mileage and date at which the engine oil is changed and maintenance operations are performed should be posted on this plate. The Vehicle Identification Number is printed on this plate, and a space is also provided to enter the owner's name.

The various points on the chassis that require a lubricant are listed in the Maintenance Schedule, Page 0-20. Maintenance should be performed according to the intervals specified on the Schedule. Use factory recommended fluids in the quantities specified.

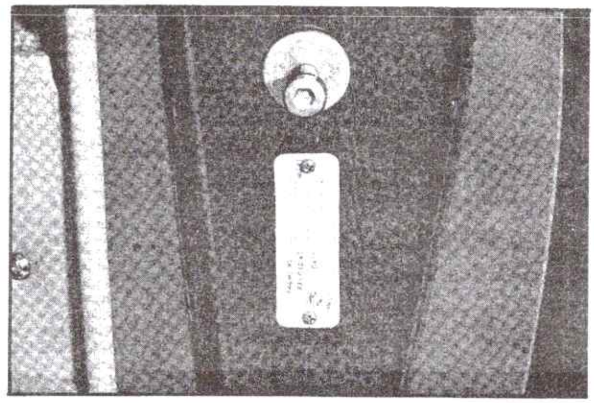


Fig. 0-7 Service Notice Plate

SERVICE INFORMATION

1. Front Suspension

Spherical joints are used on the front suspension system at the outer ends of the upper and lower control arms, and at the inner and outer steering linkage tie rod pivots.

The front suspension spherical joints should not need repacking throughout their entire service life under normal driving conditions. At the time of an engine oil change, visually inspect all joint seals for any indication of damage, such as cuts, tears, ruptures, worn spots, etc. If a damaged seal is evident, the seal must be replaced and the joint repacked.

Special front suspension lubricant is provided in one pound cans and is available from Parts Warehouses. The repacking gun used with the lubricant has a red band around the bottom of the body cylinder.

The procedure for replacing and repacking the upper and lower suspension arm spherical joint seals is described in Section 3, Notes 7, 8 and 9 for the standard car, and Notes 25, 26 and 29 for the 693 series car.

Extended life spherical joints are used at both inner and outer tie rod pivots. The only maintenance normally required is to inspect the seals for physical damage each time the engine oil is changed. There is no provision for repacking these joints except on 693 series cars. If periodic inspection reveals a damaged seal on 693 series cars, the seal may be replaced and the joint repacked as described in Section 9, Note 28. A damaged seal or a loose joint found on standard series cars or a loose joint on 693 series cars requires replacement of the joint as described in Section 9, Notes 22 and 28.

2. Engine

a. Engine Oil Recommendations

The original factory fill oil will perform satisfactorily during the normal change interval specified on the Engine Oil Change Interval and Viscosity Chart, Page 0-19, because this oil meets General Motors Standard GM 4745-M. The same chart should also be consulted for factory recommendations if additional oil should be necessary prior to the normal change interval.

The use of proper engine oil is the best assurance of continued reliability and performance from a Cadillac engine. Cadillac does not recomment oils by brand name, as assurance of oil quality is the responsibility of the refiner. Instead, the factory recommends oils that, according to their labels, are: (1) intended for service "MS", and (2) represented as passing car makers' tests or General Motors Standard GM 4745-M. Cadillac Servicemen should assist owners in the selection of the proper oil that meets the above requirements, as well as the proper viscosity number for a particular area.

In areas where the temperature seldom drops below zero, most 10W oils are satisfactory for easy starting of the engine. When the temperature is frequently below zero, a 5W or 5W-20 oil is recommended.

b. Adding Engine Oil (Fig. 0-8)

Always maintain the correct oil level. Oil should be added only when the level reaches the "Add One Quart" mark on the dipstick. Do not

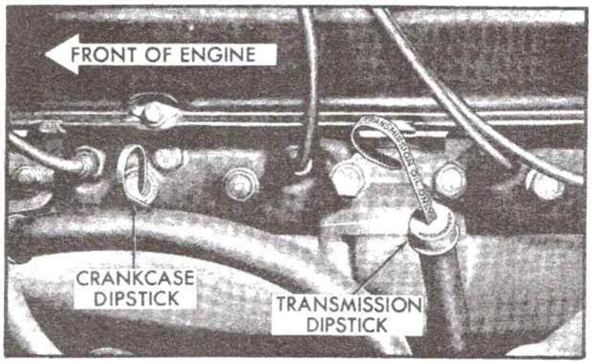


Fig. 0-8 Dipstick Locations (693)

fill above the "Full" mark or foaming may result.

c. Changing Engine Oil

The crankcase should be drained only after the engine has been warmed to normal operating temperature. The benefits of draining are minimized if the crankcase is drained when the engine is cold, as some suspended foreign matter will cling to the internal engine parts and will not drain with the slower moving colder oil.

The Engine Oil Change Interval and Viscosity Chart, Page 0-19, will serve as a guide for the proper oil change interval and oil viscosity to be used at the prevailing temperature. It is unnecessary to change the oil for the occasional unseasonably cold or warm day encountered during the fall or spring season. The crankcase capacity is 4 quarts. Do not add more than 4 quarts except when changing oil filter element, in which case 5 quarts should be used.

3. Engine Accessories

a. Distributor

The 1967 Cadillac distributor is permanently lubricated and requires no periodic oiling. However, in the event the distributor is disassembled and the shaft or breaker plate is removed, the wick in the oil reservoir should be moistened with light weight engine oil.

b. Oil Filler Cap (Figs. 0-9, 0-10, 0-11, 0-12)

Two types of oil filler caps are used for all 1967 Cadillac engines. For the standard series cars, the closed filler cap, Fig. 0-10 is used only on those cars delivered in California. All other standard series cars use the open type breather cap, Fig. 0-9. All 693 series cars use the closed system shown in Figs. 0-11, 0-12.

CAUTION: Under no circumstances should a Closed Type breather cap be used on an Open Type system as engine damage will result.

Whenever the engine oil is changed, the metal gauze in the Open Type breather cap should be cleaned in solvent and re-oiled with engine oil.

On closed type systems, the metal gauze in the strainer, located on the wall of the carburetor air cleaner on standard cars or on the rocker arm covers of all 693 series cars, should be cleaned in solvent and re-oiled with engine oil whenever the engine oil is changed.

c. Carburetor Air Cleaner (All Except 693)

The carburetor air cleaner, Figs. 0-9, 0-10,

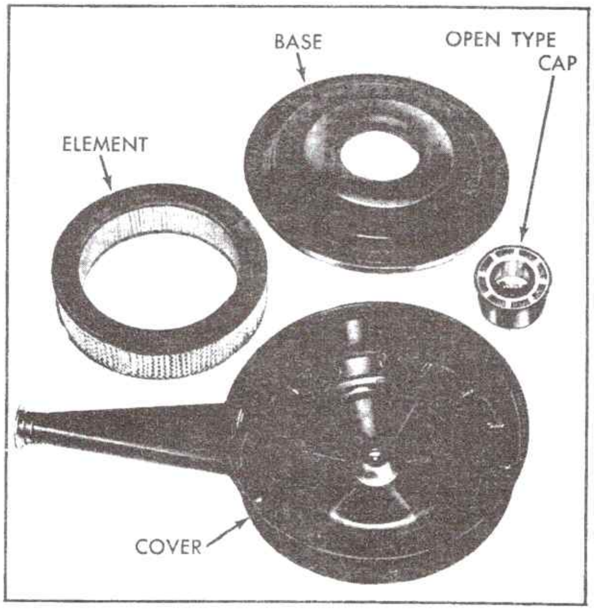


Fig. 0-9 Air Cleaner - Open (Except 693)

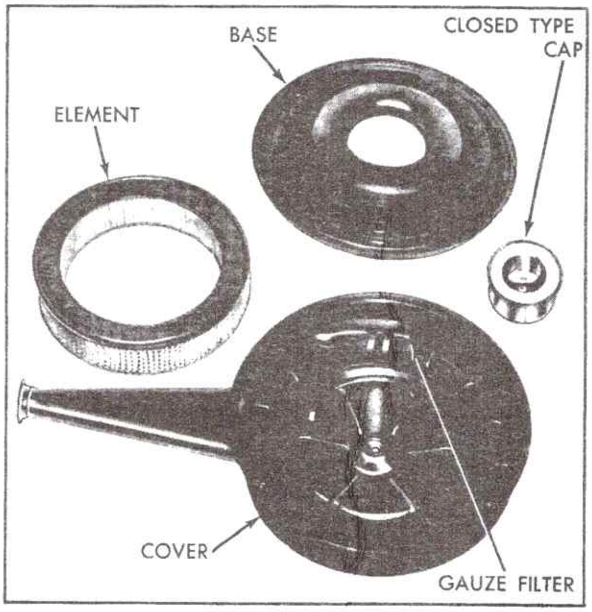


Fig. 0-10 Air Cleaner - Closed (Except 693)

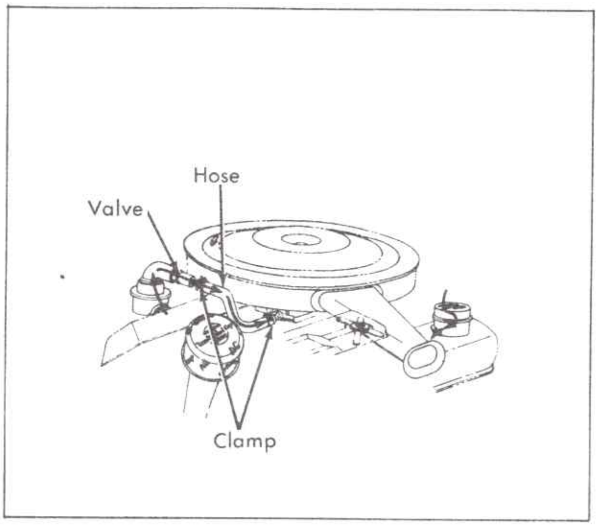


Fig. 0-11 Crankcase Ventilating System - Open (693)

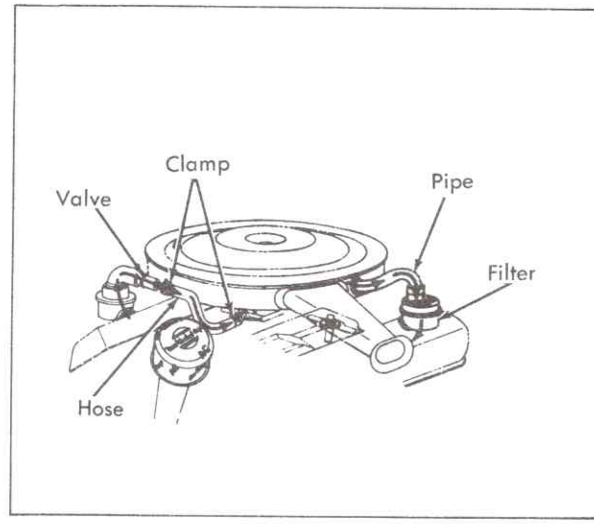


Fig. 0-12 Crankcase Ventilating System - Closed (693)

used on the engines of all 1967 Cadillac standard series cars incorporates a replaceable paper element. A new air cleaner element should be installed every 24,000 miles. More frequent replacement of the element may be necessary if the car is constantly driven in dusty areas. A visual inspection of the element is recommended every spring and fall to make certain that it is properly seated and that there is no indication of dust leakage. If damage is indicated at time of visual inspection, the element should be changed. To replace element, proceed as follows:

1. Remove air cleaner to air compressor hose on cars with Automatic Level Control.

2. Remove cover from carburetor air cleaner.

3. Remove element and discard.

4. Wipe all dirt from inside air cleaner cover.

5. Install a new element on air cleaner base, making certain that it is properly seated, and replace air cleaner cover.

d. Carburetor Air Cleaner (693 Only)

The carburetor air cleaner, Fig. 0-11, used on the engine of the Fleetwood Eldorado incorporates an oil wetted polyurethane foam element.

The element should be cleaned and re-oiled with SAE 10W-30 engine oil each 12,000 miles or 12 months. To service the element, wash it thoroughly in kerosene and squeeze dry. Dip element in engine oil and squeeze to remove excess oil.

A visual inspection of the element is recommended every spring and fall to make certain that it is properly seated and that there is no indication of dust leakage. If damage is indicated at time of visual inspection, the element should be replaced. To remove element, follow the procedures for the standard car in Note c.

e. Engine Oil Filter (Fig. 0-13)

The engine oil filter used on 1967 Cadillac cars is of the full-flow type incorporating a throw-away element. It is recommended that the element be replaced at 6,000 miles, and then each six months or each 6,000 miles thereafter, whichever occurs first.

The full-flow type oil filter filters 100% of the oil delivered by the oil pump. For this reason, it is very important that the recommended oil filter change intervals be followed.

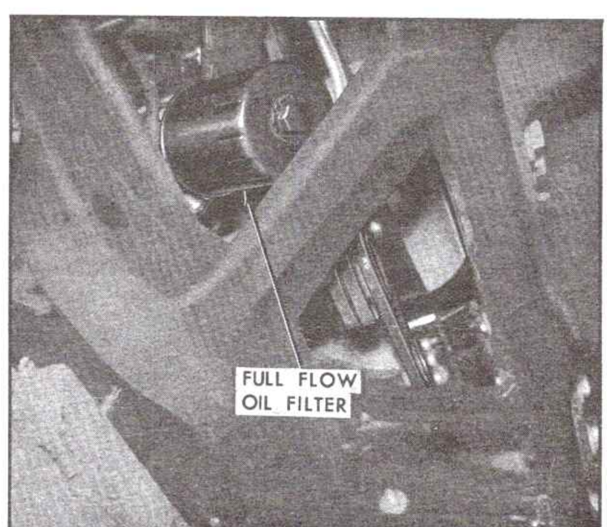


Fig. 0-13 Engine Oil Filter

The oil filter is mounted on the front right side of the front cover, Fig. 0-13. Access to the filter is gained from under the car. Replacement procedure is as follows:

1. Position car on hoist and remove rubber splash shield.

2. Unscrew element from filter base and discard element.

3. Wipe gasket area of base clean.

4. Place a light film of silicone on top of gasket and screw element on stud of filter base by hand until gasket touches filter base. Then tighten element an additional 2/3 of a turn.

5. Add 1 quart of oil to engine crankcase.

NOTE: If engine oil is changed in conjunction with oil filter replacement, add 5 quarts of oil to engine crankcase.

6. Operate engine at fast idle and check for oil leaks at filter base.

7. After engine has run for 3 to 4 minutes, stop engine and check oil level.

f. Positive Crankcase Ventilation

Two types of Positive Crankcase Ventilation systems are used. The closed system installed on cars shipped to the state of California and all 693 series cars uses a non-ventilated oil filler cap and a strainer air cleaner, Figs. 0-10, 0-12. The system installed on all other cars uses a ventilated oil filler cap which is equipped with a filter, Fig. 0-9.

The positive crankcase ventilator valve installed on all 1967 Cadillac vehicles should be replaced every 12,000 miles, or 12 months, whichever occurs first.

NOTE: Cleaning of the open type oil breather cap or the air cleaner strainer is important in order to provide proper crankcase breathing. The strainer is located on the inside wall of the carburetor air cleaner on standard cars. On 693 series cars, two strainers are used; one on each rocker arm cover. The metal gauze in each unit must be cleaned and re-oiled at every engine oil change.

4. Battery

The battery electrolyte level should be checked at every engine oil change. In warm weather, a check should be made at two-week intervals. An electrolyte level indicator vent cap is located in the second cell cap from the positive battery post. With the use of this vent cap, it is not necessary to remove cell vent caps when checking fluid level. A dark (black) spot in the center of this vent cap is visible when electrolyte is at the normal level. If at any time the electrolyte level drops below normal, the spot changes from black to an off-white color. When an off-white condition is encountered, all cell fluids must be adjusted to their correct level. This is accomplished by raising the fluid level to the bottom of the slot in each vent well with colorless, odorless drinking water.

CAUTION: Do not overfill battery or add any substance to fluid except colorless, odorless drinking water.

Keep battery, cable clamps and hold-down bracket clean. If necessary, clean with a solution of ammonia and water, or baking soda and water. Flush off with water and apply petroleum jelly to cable clamps and terminals to retard corrosion.

5. Air Injection Reactor

The Air Injection Reactor, installed on all cars registered in the State of California, reduces air pollution by burning exhaust gases in the cylinder heads.

The system has a belt driven air pump, special cylinder heads, and a special carburetor.

Specific maintenance requirements must be followed to insure satisfactory operation of the pump and to maintain air pollution control.

Proper engine idle speed, fuel-air mixture and belt tension adjustments are required at 1,000 miles and every 12,000 miles or 12 months thereafter, whichever occurs first. See Section 6, Notes 63a and 99b.

The Air Injection Reactor pump air cleaner, located on the left rocker arm cover (all except 693 series) or at the rear of the radiator cradle on the left hand side (693 series only) should be cleaned every 12,000 miles or 12 months, whichever occurs first. More frequent replacement of the element may be necessary if the car is constantly driven in dusty areas.

To service the filter element, remove element as described below, wash in kerosene and squeeze dry. Dip element in SAE 10W-30 oil and squeeze to remove excess oil. Do not over-oil the filter as oil droplets carried through the intake hose will damage the pump.

To remove element, proceed as follows:

1. Remove retaining spring.

2. Unscrew top and remove filter element.

3. Wipe all dirt from inside air filter body.

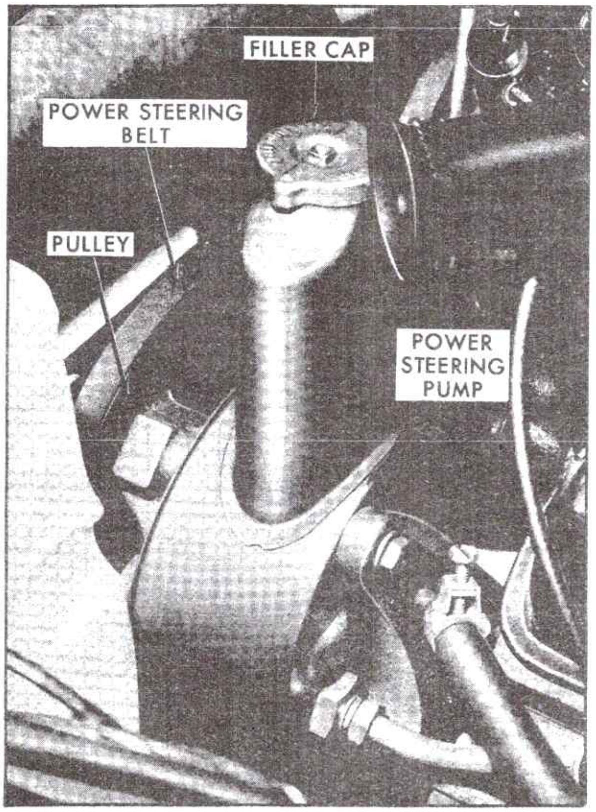


Fig. 0-14 Power Steering Reservoir

4. Clean element and install in air filter body, making certain that it is properly seated and tighten cover.

5. Install air filter in bracket and secure with retaining spring.

6. Power Steering

The steering gear is lubricated by the power steering fluid and requires no other lubricant. The fluid level in the pump reservoir, Fig. 0-14, should be checked every spring and fall after the engine is warm, and the reservoir kept filled with Cadillac recommended fluid. If the dipstick indicates that the fluid level is extremely low, the unit should be inspected for leaks and corrected immediately. When adding less than one pint of fluid, automatic transmission fluid may be used. When adding larger quantities or when making a complete fluid change, always use special power steering fluid. Refer to Section 9, Note 1, for checking fluid level.

7. Power Brakes

The brake fluid level of both sections of the master cylinder, Fig. 0-15, should be checked at every engine oil change and every time the power brakes are serviced. The reservoir cover incorporates a diaphragm that provides a seal between the reservoir fluid and the atmosphere to prevent moisture absorption or dust contamination.

If either the front or rear brake reservoir is found to be low, the related hydraulic system should be checked for leaks. Then fill the reservoir with SAE Delco Supreme 11 Super Heavy Duty Brake Fluid, to within 1/4 inch to 1/2 inch of the reservoir sealing surface.

Check the travel of the service brake pedal and the parking brake pedal at the first oil change and each spring and fall thereafter. Excessive brake pedal travel is an indication of brake system malfunction.

Within the first 500 miles, service brake pedal travel should not exceed 1-3/4 inch during normal brake pedal application of approximately 30 pounds force. On cars with more than 500 miles, pedal travel should not exceed 1-1/2 inch with moderate application (30 pounds force). The parking brake pedal should travel 1-3/4 inch to 2-3/4 inch with moderate application (50 pounds force). If parking brake adjustment is required, lubricate parking brake links and cables.

Refer to Section 5 for adjustment procedures should either pedal travel be found incorrect.

8. Air Conditioner Compressor

The 6 cylinder compressor uses 525 viscosity oil. It is important that only the type of oil recommended by the compressor manufacturer be used. Refer to Section 1, Note 23 for lubricating recommendations.

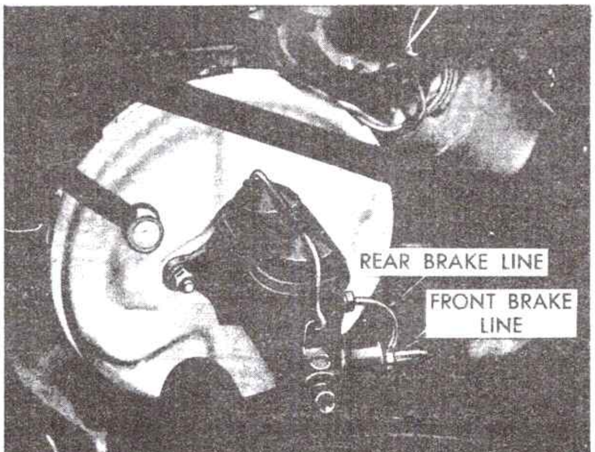


Fig. 0-15 Power Brake Reservoir

9. Transmission

a. Oil Recommendations

The correct transmission fluid bears a suffix letter "A" following the numerals in its "AQ-ATF" designation. This fluid must always be used both for adding and refilling. Suffix "A" fluid incorporates additives not found in regular type "A" fluid that are essential for satisfactory transmission performance.

The transmission bottom pan should be drained every 24,000 miles or two years, whichever occurs first, and fresh fluid added to obtain the proper level on the dipstick. For cars subjected to heavy city driving, or in commercial use where the engine is regularly idled for prolonged periods, the bottom pan should be drained every 12,000 miles.

b. Checking Fluid Level (Fig. 0-8)

The dipstick and filler tube for the transmission is located under the hood at the right rear side of the engine (left side on 693 only. See Fig. 0-8).

The fluid level should be checked at every engine oil change. Add fluid, if necessary, until proper level is indicated on dipstick, Fig. 0-16. Proper fluid level is based on operating temperature. When checking fluid level, first run the engine at 800 rpm with selector lever in "P" (Park) position for 1-1/2 minutes to make certain converter is full. Reduce engine speed to slow idle, remove and wipe dipstick, then check fluid level.

With the engine still running, add fluid through dipstick tube to bring the fluid to the proper level.

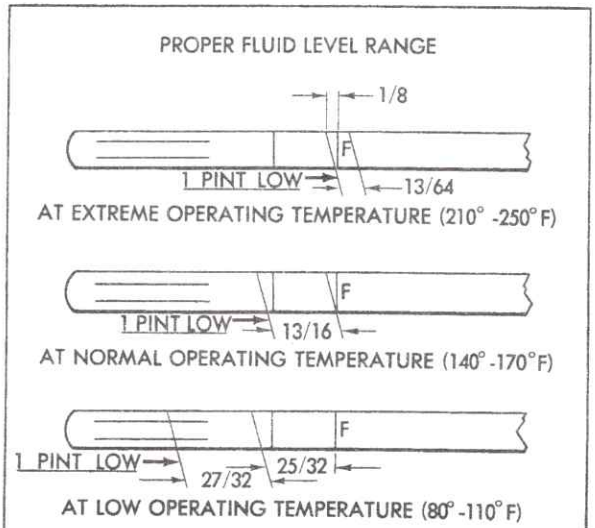


Fig. 0-16 Transmission Oil Level (Except 693)

At normal operating temperature 1 pint of fluid will change the level from the low mark (bottom dimple) to the full mark ("F").

c. Transmission Fluid Change

1. Raise car on hoist or place on jack stands.

2. Remove bottom pan and empty fluid from bottom pan.

3. Install bottom pan using a new gasket.

4. Lower car and add 2 quarts of transmission fluid through filler tube.

5. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

6. Reduce engine speed to slow idle and check fluid level. Add fluid, if necessary, to bring to proper level, Fig. 0-16.

d. Oil Strainer

The oil intake system incorporates an oil strainer in the transmission oil sump. The intake pipe and strainer assembly must be replaced after the first two years or 24,000 miles only, or after a major transmission failure. The procedure for removing and installing the oil strainer is described in Section 7, Note 7c.

10. Front Wheel Bearings (Standard Car) Rear Wheel Bearings (693 Only)

The wheel bearings on all 1967 Cadillac cars require repacking and adjusting when the brake linings or components are replaced. When repacking these bearings, use a #2 grade lithium high melting point wheel bearing grease free from any fillers or abrasives. Refer to Section 10, Note 3 for repacking procedure.

11. Differential (Except 693 Style)

Check the lubricant level in the differential only on the first inspection and add lubricant if necessary. The differential lubricant level should be within 1/2 inch of the lower edge of the filler hole. At subsequent engine oil changes, inspect differential assembly for external signs of leakage and check lubricant level only if leakage is evident.

Either SAE 90 multi-purpose type gear lubricant conforming to MIL-L-2105-B specifications

or the special lubricant provided for this purpose by the Parts Department can be used for cars equipped with the standard differential. Cars equipped with the Controlled Differential should use only the special lubricant provided by the Parts Department to assure the satisfactory operation of this unit. When removing the filler plug, take extreme care not to allow any dirt to enter the filler hole.

Draining and refilling of the differential is necessary only at time of replacement.

12. Final Drive (693 Only)

Check the lubricant level in the final drive only at the first inspection and add lubricant if necessary. The final drive lubricant level should be within 1/2 inch of the lower edge of the filler hole. At subsequent engine oil changes, inspect the final drive assembly for signs of external leakage at the output shaft seals and at the pan gasket, and check lubricant level only if leakage is evident.

The factory recommended fluid for the final drive assembly is SAE 90 multi-purpose type gear lubricant conforming to MIL-L-2105-B specifications.

When removing the filler plug, take extreme care not to allow any dirt to enter the filler hole.

Draining and refilling of the differential is necessary only at time of replacement.

13. Propeller Shaft (Except 693 Style)

The 1967 propeller shaft does not require maintenance on a regularly scheduled basis, nor can it be disassembled. However, whenever the shaft is disconnected at the transmission, lubricate the outside diameter of the front propeller shaft yoke with Automatic Transmission Fluid, Type "A", and the inside diameter with synthetic oil seal lubricant as outlined in Section 4, Note 27.

14. Chassis Sheet Metal

Lubrication of the hood latch mechanisms and hood hinges is an important part of the general lubrication operation. The following lubrication services should be performed every spring and fall.

a. Hood Latch Mechanisms

Apply a small amount of lubricant to the striking surface, and apply light oil to the moving joints of all hood primary and secondary latch mechanisms and hinges.

b. Hood Hinges

Apply a few drops of light oil to all the moving joints of the hood hinges.

c. Gasoline Tank Filler Door Hinges (693 Only)

Apply a few drops of light oil to all moving joints of the gasoline tank filler door hinges.

15. Body Lubrication Points

The movable mechanical parts of the body are lubricated during production to insure proper and quiet operation. If additional lubrication is required, lubricants should be used at the locations listed, and in the manner indicated.

Each lubrication point shown in Fig. 0-16 is designated by a letter that corresponds with a letter in the note headings below.

While the pictures in Figs. 0-17, 0-18, and 0-19 represent parts of the standard car, the corresponding places of the Eldorado should also be lubricated as outlined below.

NOTE: The Lubriplate referred to in this section is Lubriplate No. 630 AAW, a zinc oxide grease. It is recommended that this type lubricant or its equivalent be used.

a. Front Door Hinge Hold-Open Assembly

Wipe off dirt and apply a light coat of Lubriplate (or equivalent) at lower arrow in Fig. 0-17. In addition, the hinge pins should be lubricated with engine oil.

b. Door Lock Fork Bolt

Wipe off dirt and apply a thin coat of stick-type lubricant and oil at points indicated.

c. Rear Door Hinge and Hold-Open Assembly

Wipe off dirt and apply a light coat of Lubriplate to frictional points indicated. Wipe off excess lubricant.

d. Door Lock Outside Handle

Apply a light coat of Lubriplate to surface of lock cylinder shaft contacting bell crank.

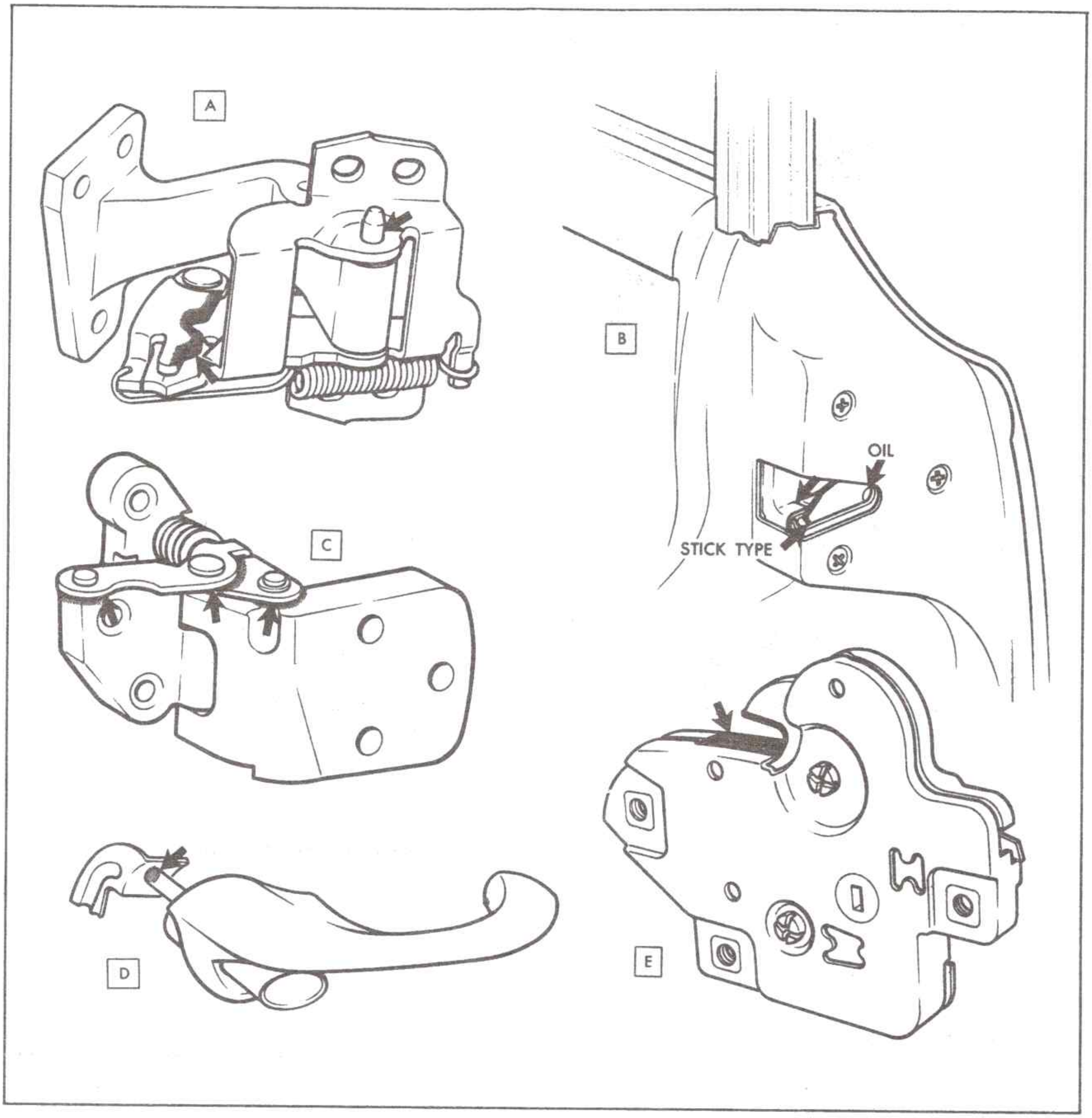


Fig. 0-17 Body Lubrication Points

e. Rear Compartment Lid Lock

On rear compartment lid lock, apply a thin film of Lubriplate at point indicated.

Front Door Torsion Rods (693 Only)

Apply a thin coat of Lubriplate at all friction points of torsion rods.

Rear Compartment Lid Hinges and Torque Rods

Apply Lubriplate to hinge and torque rods at friction points.

Front Seat Adjuster Mechanism, Manually and Electrically Operated

Thoroughly wipe off old lubricant. Apply a thin coat of Lubriplate to jack screws and seat tracks.

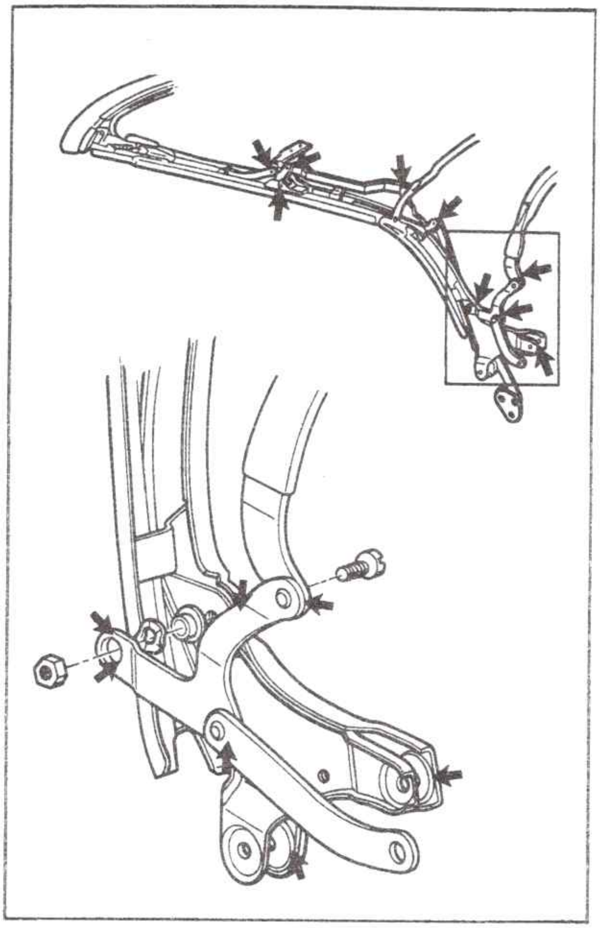


Fig. 0-18 Folding Top Linkage

Operate seat to limits of all positions. Apply a small amount of dripless oil to linkage and wipe off excess lubricant.

Folding Top Linkage

Apply a small amount of light oil to all bearing points, Fig. 0-18. Wipe off excess lubricant to prevent soiling trim.

Folding Top Lift Cylinder Piston Rods

With folding top in raised position, wipe exposed portion of each top lift cylinder piston rod with a cloth dampened with brake fluid to remove any oxidation or accumulated grime. With another clean cloth, apply a light film of brake fluid to the piston rods to act as a lubricant.

NOTE: Use caution so that brake fluid does not come in contact with any painted or trimmed parts of the body.

Window Regulators, Cams and Guides

Apply a coat of Lubriplate to regulator teeth, cams and guide channels as required. Fig. 0-19 is typical of front and rear door windows and rear quarter windows.

16. Points Requiring No Lubrication

No lubrication is required at the generator, distributor, water pump, propeller shaft bearings, or rear wheel bearings (except 693), as all of these bearings are packed with sufficient lubricant at time of assembly.

In addition to the above, lubrication is not required at any of the following locations:

a. Front upper and lower suspension arm pivot points.

b. Pitman arm or idler arm pivots.

c. Manifold heat control valve.

d. Front and rear pivot points of rear upper and lower control links.

e. Rear springs, shackles, or spring liners on Commercial Chassis and 693.

f. Tie rod linkage.

17. 10-Point Safety Inspection

The following 10-point safety inspection should be performed once a year. However, some states require more frequent inspection.

1. Brake System

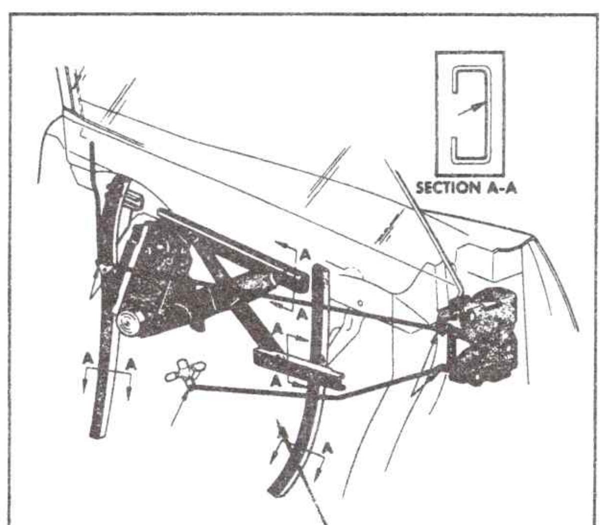


Fig. 0-19 Window Linkage

a. Check hydraulic fluid level in master cylinder.

b. Check brake pedals (parking and service) for excessive travel.

c. Check brake linings for wear.

d. Check for equalization of braking action.

2. Lights

a. Check for burned out or broken bulbs at all points. Replace where required.

b. Check for broken or cracked lenses. Replace where required.

c. Check headlight aim as described in Section 12, Note 1.

3. Turn signals and hazard warning flasher

a. Check for proper operation of all turn signal and cornering lights.

b. Check for proper operation of both front fender turn signal indicators.

4. Steering and Wheel alignment

a. Check for excessive play in steering gear.

b. Check for looseness in tie rod ends and idler arm.

c. Check all spherical joints for looseness.

d. Check front suspension for proper alignment.

e. Check for bent or damaged wheels.

5. Tires

a. Check condition of tread.

b. Check tread pattern for uneven wear.

c. Check all tires for cuts or bulges.

d. Check all tires for proper inflation pressure.

6. Exhaust System

a. Check exhaust system for proper mounting arrangement.

b. Check exhaust system for leaks.

c. Check for missing, damaged or badly corroded parts.

7. Glass and Mirrors

a. Check all glass for cracked or broken conditions.

b. Check all glass for discoloration that would limit visibility.

8. Windshield Wipers and Washers

a. Check for proper operation of windshield wiper motor and switch.

b. Check condition of windshield wiper blades.

c. Check windshield washers for proper operation.

9. Windshield De-icer and De-Fogger

Check for proper operation of windshield de-icer and de-fogger and rear window de-fogger on cars so equipped.

10. Horn

Check for proper operation of horns.

PREVENTIVE MAINTENANCE

18. Periodic Preventive Maintenance Operations

a. Cooling System

Flush every 24 months with clear water and add ethylene glycol coolant, rust inhibitor and sealer to the radiator. Refer to Section 6, Note 1 for information on the preparation of the cooling system for cold weather.

b. Fuel Filter Element

Replace fuel filter element every spring and fall.

c. Engine Oil Filter

Replace filter every 6 months or 6,000 miles, whichever occurs first.

d. Air Conditioner

On all Air Conditioning Systems, before Summer use:

1. Clean out insects and dirt from condenser.

2. Check compressor belt tension.

3. Check overall performance of Air Conditioner.

4. Check sight glass for full charge of refrigerant.

5. Leak test system for refrigerant and oil leaks.

For complete Air Conditioner maintenance, see Section 1, Note 10.

MAINTENANCE SERVICE AND SCHEDULE

A program of preventive maintenance has become an essential part of vehicle operation. The proper care and maintenance of a new Cadillac as set forth in the Cadillac Owner Protection Plan booklet will preserve an owner's investment, avoid expensive repairs and will ultimately result in lasting satisfaction for the Cadillac owner. When new Cadillac cars are brought in for service, the suggested inspections and maintenance services as listed in the Owner Protection Plan booklet should be performed by the Serviceman. These inspection and maintenance services are those which experience and testing have shown to be the most likely needed services at that particular mileage or time interval for an average owner. However, driving habits, driving conditions, geographical locations and climatic conditions all influence maintenance requirements.

In addition to these maintenance services, some components of the vehicle may require periodic maintenance depending upon usage.

The Cadillac Serviceman should also recommend additional items of maintenance based on conditions such as local weather, owner driving habits, and periodic factory service bulletins.

The maintenance schedule outlined on pages 0-20 and 0-21 will provide the Serviceman with an excellent reference for seasonal maintenance recommendations as well as regular inspections and maintenance services.

ENGINE OIL CHANGE INTERVAL AND VISCOSITY CHART

Prevailing Temperature	SAE Viscosity* Recommendations	Change Interval**
Above Freezing (+32°F.)	SAE-20W SAE-10W-30	Every 60 days, never to exceed 6,000 miles.
Below Freezing (+32°F. to 0°F.)	SAE-10W SAE-10W-30	
Below 0°F.	SAE-5W SAE-5W-20	

*Choice of engine oil should be restricted to those oils which, according to the label are: (1) intended for "MS" service, and (2) represented as passing car makers' tests or General Motors Standard GM 4745-M.

**If there is danger of oil contamination by dust, water, or other foreign material during very extreme driving conditions, then the engine oil should be changed more frequently than shown in the table. In such cases, an engine oil change is recommended after 2,000 or even 1,000 miles of driving.

MAINTENANCE SCHEDULE

Interval	Service To Be Performed
Every 60 days, never to exceed 6,000 miles	Change engine oil. Inspect front suspension. Check tires for damage, wear and proper inflation. Check underside of car for excess dirt, (mud, gravel, tar, etc.) paying particular attention to propeller shaft, wheels, and brake drums. Clean and oil engine breather cap, (open type). Clean and oil strainer in carburetor air cleaner (California cars except 693). Clean and oil strainers on rocker arm covers - 693 only) Check brake fluid level. Check battery electrolyte level. Check transmission fluid level. Check power steering fluid level. Check coolant level in radiator.
Every 6 months or 6,000 miles	Change engine oil filter (in connection with an oil change). Check and adjust all engine drive belts. Check, clean and/or adjust spark plugs, ignition points, timing and engine idle. Check all brake lines for leaks and damage. Check brake pedals (parking and service) for travel.
Every 6,000 miles	Rotate tires.
Every 12 months or 12,000 miles	Check brake linings for wear (every six months after the first inspection). Lubricate parking brake cables (every six months after the first inspection). Replace positive crankcase ventilation valve. Clean, inspect or replace, if necessary, crankcase ventilation system hoses, fittings and attaching parts. Test operation of A.I.R. pump and adjust pump pulley belt tension (California cars only). Clean and oil A.I.R. pump filter (California cars only). Clean and oil carburetor air cleaner element. More frequent cleaning may be necessary if vehicle is driven in dusty areas. (693 only)
Every 12 months	Perform 10-point safety inspection as outlined in Note 17.
2 years or 24,000 miles	Drain transmission bottom pan every 24,000 miles or 2 years, whichever occurs first, and add fresh fluid. (normal passenger car usage) Replace intake pipe and strainer assembly after the first 24,000 miles or 2 years only, or in any case of major transmission failure. Replace carburetor air cleaner element. More frequent replacement may be necessary if vehicle is driven in dusty areas. (All except 693) Clean and oil clock. Flush cooling system and refill with ethylene glycol base coolant solution. Add cooling system inhibitor and sealer.

MAINTENANCE SCHEDULE (Cont'd.)

Interval	Service To Be Performed
Every spring	Check manifold heat valve. Oil accelerator linkage. Check transmission for leaks and oil linkage. Check and open muffler drain hole. Check differential for leaks. (All except 693) Check final drive assembly for leaks (693 only). Inspect and open body and door drain holes. Check cooling system for leaks. Change fuel filter element. Inspect carburetor air cleaner for dust leaks. Leak test complete air conditioning system. Lubricate all hood primary and secondary latch mechanisms and hinges. Oil door hinges, etc. Oil fuel filler door (693 only). Check engine for oil leaks. Check condition of radiator and heater hoses.
Every fall	Check manifold heat valve. Oil accelerator linkage. Check transmission for leaks and oil linkage. Check and open muffler drain hole. Check differential for leaks. (All except 693) Check final drive assembly for leaks (693 only). Inspect and open body and door drain holes. Check cooling system for leaks and test coolant. Add inhibitor and sealer to cooling system (after 24,000 miles). Inspect carburetor air cleaner for dust leaks. Change fuel filter element. Check choke operation. Clean battery terminals and clamps. Lubricate all hood primary and secondary latch mechanisms and hinges. Oil door hinges, etc. Oil fuel filler door (693 only). Check engine for oil leaks. Check condition of radiator and heater hoses.

FLUID CAPACITIES

Unit	All Series Unless Otherwise Noted	
	U. S. Measure	Imperial Measure
Engine Crankcase	4 Quarts	3-1/4 Quarts
When Filter is Changed	5 Quarts	4-1/4 Quarts
Cooling System		
With Air Conditioning (Except 693)	19 Quarts	15-3/4 Quarts
With Heater Only (Except 693)	18 Quarts	15 Quarts
Without Heater and/or Air Conditioning (Except 693)	16 Quarts	13-1/4 Quarts
75 Series Only	20-1/2 Quarts	17 Quarts
With Air Conditioning (693 Only)	17-1/2 Quarts	14-1/2 Quarts
With Heater Only (693 Only)	17 Quarts	14-1/4 Quarts
Without Heater and/or Air Conditioning (693 Only)	16 Quarts	13-1/4 Quarts
Air Conditioner - Refrigerant 12	4 Pounds	4 Pounds
75 Series Only	5-1/4 Pounds	5-1/4 Pounds
Air Conditioner Compressor Oil - 525 Viscosity	10-1/2 Fluid Ounces	8-3/4 Ounces
75 Series Only	13-1/2 Fluid Ounces	11-1/4 Ounces
Rear Axle (Except 693)	5 Pints	4-1/2 Pints
Final Drive (693 Only)	4-1/2 Pints	3-1/4 Pints
Gasoline Tank (All std. series)	26 Gallons (Approx.)	21-3/4 Gallons (Approx.)
Commercial Chassis	20 Gallons (Approx.)	16-3/4 Gallons (Approx.)
Fleetwood Eldorado	24 Gallons (Approx.)	20 Gallons (Approx.)
Turbo-Hydra-matic Transmission (Except 693)		
Dry	11 Quarts, 6 Ounces	9-1/4 Quarts
Pan and Strainer Removed	3-1/2 Quarts	3 Quarts
Turbo Hydra-matic Transmission (693 Only)		
Dry	13 Quarts	10-3/4 Quarts
Pan and Strainer Removed	5-1/2 Quarts	4-1/2 Quarts

FACTORY RECOMMENDED FLUIDS

Unit	Fluid Recommendations
Transmission	Automatic Transmission Fluid AQ-ATF, followed by either three or four digits and the suffix letter "A".
Brake System	SAE Delco Supreme 11 Super Heavy Duty Brake Fluid or brake fluids conforming to SAE 70-R3 Specifications.
Differential (All except 693)	SAE 90 "Multi-Puprose" lubricant conforming to MIL-L-2105-B specifications (Standard Differential only). Special rear axle Lubricant available from servicing Parts Warehouse (Standard and Controlled Differential).
Final Drive (693 only)	SAE 90 "Multi-Purpose" lubricant conforming to MIL-L-2105-B specifications.
Power Steering System	Cadillac power steering fluid available from servicing Parts Warehouse.
Propeller Shaft Front Slip Yoke (Fleetwood Seventy-Five Sedans and Limousines and Commercial Chassis)	Type "A" Transmission Fluid.
Propeller Shaft Slip Yoke (680, 681, 682, 683)	Outside Diameter with Type "A" Transmission Fluid. Inside Diameter with Synthetic Oil Seal Lubricant.

HEATING

The 1967 Cadillac heating system uses the air-mix system of heat regulation. With the exception of the distribution ducts, all components are mounted on the firewall in the engine compartment. Construction features of the system differ, depending on whether or not the car is equipped with air conditioning.

Automatic Climate Control air conditioning is standard equipment on 1967 Fleetwood Seventy-Five models and available as an option on all others.

The heating system on cars without air conditioning incorporates a single heater-blower assembly mounted on the right hand side of the firewall, Fig. 1-1. This unit provides heated air for the front and rear passenger compartments, and to the windshield for defogging and defrosting.

Outside air is drawn through the cowl air intake grille, through the ventilation duct, and into the heater-blower assembly. The blower motor then forces a portion of the incoming air through the heater core into the distributor duct. The remaining incoming air is forced directly into the distributor duct. To obtain the desired discharge air temperature, the heated and unheated air are mixed in the necessary proportions.

The temperature of the air discharged into the passenger compartment is controlled by the temperature door inside of the heater blower assembly. This door regulates the mixing of the heated and unheated air.

Heated air is delivered to the front of the passenger compartment through openings in the heater distributor, located in the center of the dash panel. Heated air for the rear of the passenger compartment passes through a Y-duct that extends rearward along the right side of the transmission tunnel, under the front carpet and seat, except Fleetwood Eldorado. Air for the defroster system is discharged through the two outlets at the top of the heater distributor.

The heater control panel, Fig. 1-2, is located below the instrument cluster to the right of the ignition switch. The four-position fan switch turns the blower motor ON and OFF, and controls the three blower speeds.

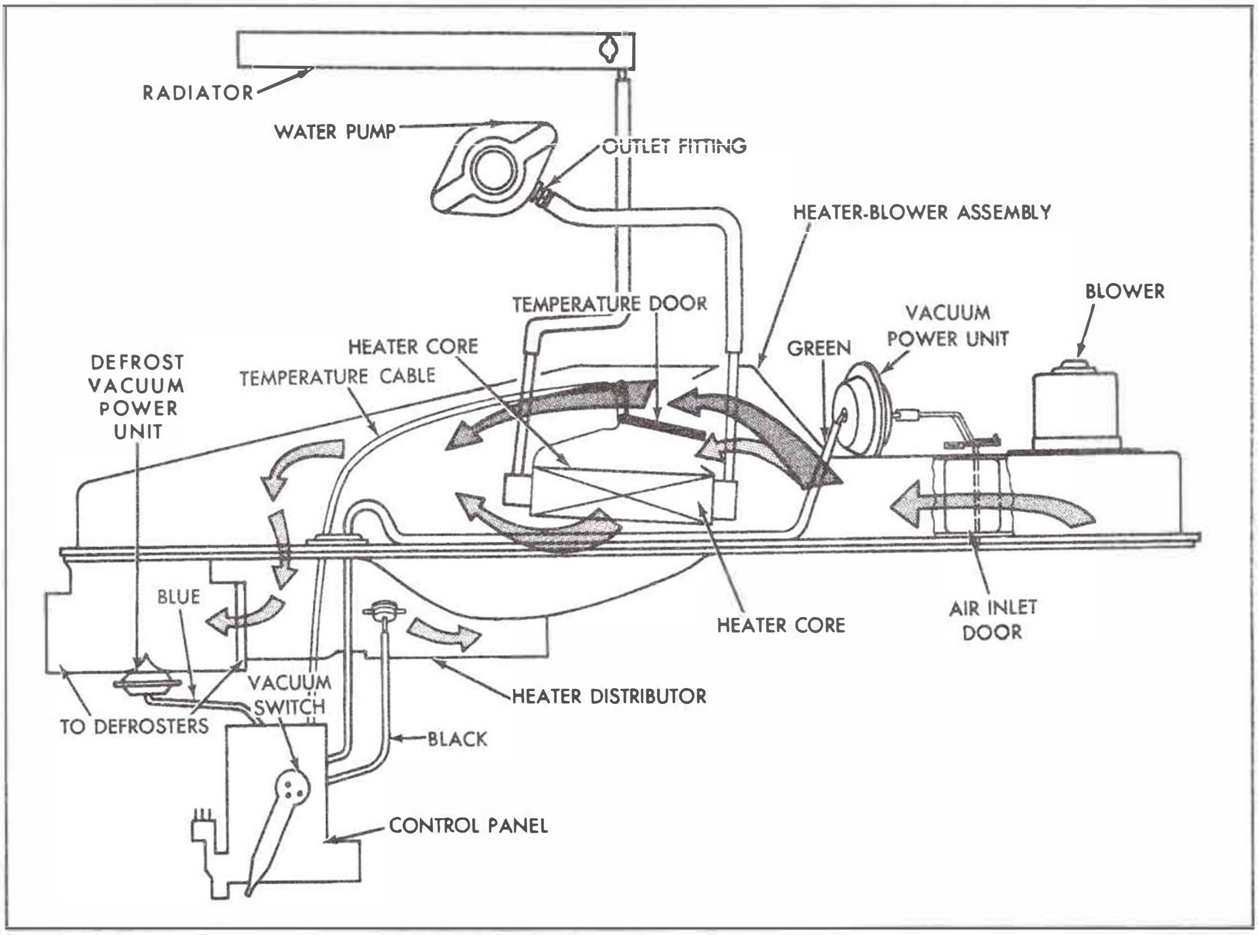


Fig. 1-1 Heater Components

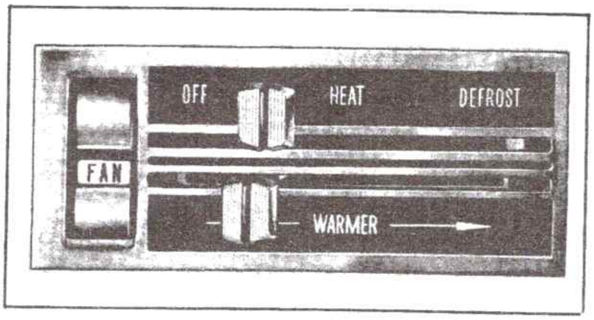


Fig. 1-2 Heater Control Panel (Except 693)

Advancing the heater-defroster lever to the HEAT position vents the vacuum operated air inlet door, Fig. 1-1, and completes the electrical circuit to the fan switch. The air inlet door opens to admit outside air into the heater-blower assembly, where it is heat conditioned and delivered to the passenger compartment in the manner previously described. In the HEAT position, the heater distributor is so designed that a small portion of the discharge air is always directed to the windshield through the defroster outlets.

Advancing the heater-defroster lever to the DEFROST position causes the vacuum operated defroster door to open so that most of the discharge air is directed to the windshield, while the remaining discharge air is directed to the floor outlets. In all positions of the heater-defroster lever, the fan switch controls the three blower speeds.

The temperature lever, Fig. 1-2, operates the temperature door, Fig. 1-1, that controls the temperature of the discharge air by regulating the mixing of heated and unheated air. With the lever in the OFF position, the air flow from the heater core is completely blocked. As the lever is moved to the right, the temperature door opens, admitting heated air into the distributor duct, and progressively decreasing the amount of unheated air. In the WARMER position, the unheated air is completely blocked, directing all of the incoming air through the heater core.

All 1967 Cadillacs, except 697, are equipped with a variable restrictor at the heater outlet fitting on the cylinder head water outlet pipe. This restrictor serves to regulate both water flow and water pressure to the heater core as the pressure in the engine cooling system rises due to increasing engine speed.

VENTILATION

The ventilation system on cars not equipped with Automatic Climate Control (except 693 and 697) consists of a control panel and two fresh air intake doors.

The ventilation control panel, Fig. 1-3, is located in the center of the instrument panel to the right of the instrument cluster and consists of two horizontal sliding levers.

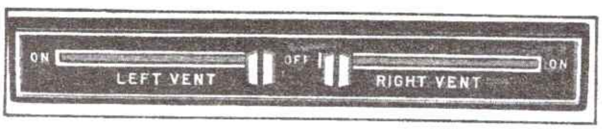


Fig. 1-3 Ventilation Control Panel (Except 693)

Moving the left lever to the left progressively increases the amount of outside air entering the passenger compartment through the air intake door located on the left lower inner cowl panel. Moving the right lever to the right progressively increases the amount of outside air entering the passenger compartment through the air intake door located on the right lower inner cowl panel.

Electrical Circuit

The heater electrical circuit is illustrated in Fig. 1-4. The current flows from the battery through the ACC terminal of the ignition switch, and through a 15 ampere fuse to the master ON-OFF switch, located on the control panel. When the master switch is closed, current flows to the blower control switch that directs it through the blower resistor, from which it flows to the blower motor, then to ground.

SERVICE INFORMATION

1. Adjustments

a. Temperature Door Cable

1. Set temperature lever in OFF position.

2. Turn plastic turnbuckle on control cable until temperature door seats on right end of travel.

3. Check adjustment by pushing temperature lever to the WARMER position. A thump should be heard at this point indicating that the temperature door has reached the end of its travel. If thump is not heard readjust cable.

b. Ventilator Cable

1. Set ventilator lever in OFF position.

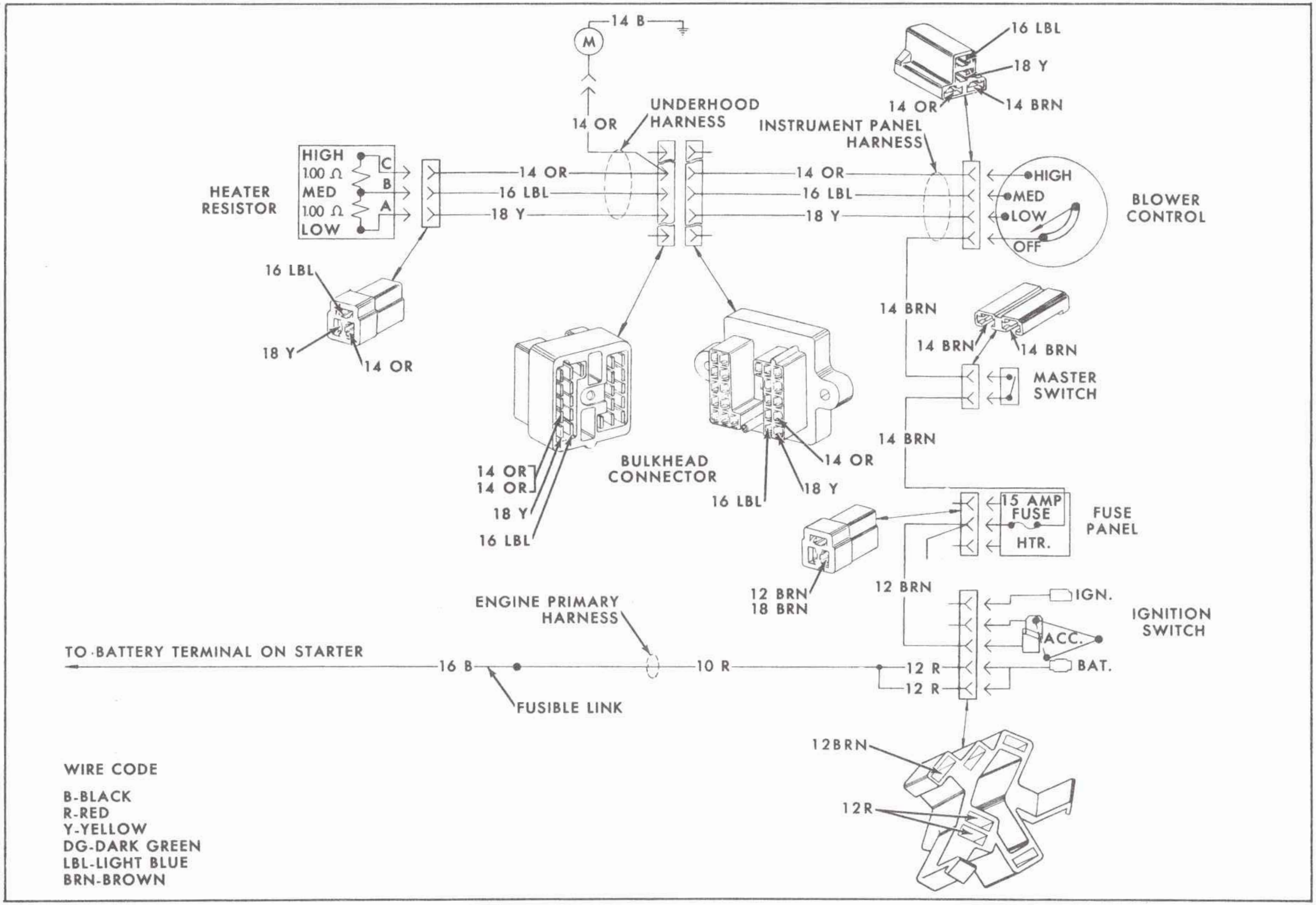


Fig. 1-4 Heater Circuit Diagram (Except 693)

2. Turn plastic turnbuckle on control cable near ventilation outlet until ventilator door closes.

2. Heater Control Panel

The procedure for removing and installing the Heater Control Panel assembly is described in Section 12, Note 58.

3. Blower Resistor (Except 693)

a. Removal

1. Disconnect electrical connector to blower resistor located on engine compartment side of dash panel.

2. Remove screw securing resistor assembly to dash panel.

b. Installation

1. Position blower resistor to engine compartment side of dash panel and secure with screw.

2. Connect electrical connector to blower resistor.

4. Heater Blower Motor (Except 693)

The heater blower motor, during HIGH speed operation, draws approximately 10 amperes of current.

a. Removal

1. Disconnect electrical connector to blower motor.

2. Remove five screws securing blower motor to heater-blower case and remove blower motor.

b. Installation

1. Position blower motor to heater-blower case and secure with five screws.

2. Connect electrical connector to blower motor.

5. Heater-Blower Assembly (Except 693)

a. Removal

1. Drain cooling system.

2. Remove blower motor as described in Note 4a.

3. Remove heater hoses from fittings on heater-blower assembly, leaving clamps on fittings.

4. Disconnect bowden cable to temperature valve at pivot point on heater-blower assembly.

5. Remove seven screws securing bottom of heater-blower assembly to cowl.

6. Remove six screws securing top of heater-blower assembly to cowl and remove heater-blower assembly.

b. Installation

1. Position heater-blower assembly to cowl and install two screws, one on either end, securing top of assembly to cowl. Tighten finger tight.

2. Re-position heater-blower assembly if necessary, and install seven screws securing bottom of assembly to cowl.

3. Install four remaining screws securing top of assembly to cowl, and tighten screws previously installed.

4. Connect heater hoses to fittings on assembly and secure with clamp.

5. Install bowden cable to temperature valve at pivot point on assembly, and adjust cable as described in Note 1a.

6. Install blower motor as described in Note 4b.

7. Fill cooling system.

6. Heater Core (Except 693)

a. Removal

1. Remove heater-blower assembly as described in Note 5a.

2. Remove four screws, two each side of heater core, securing wire retaining clamps to heater-blower case, and remove retaining clamps.

3. Pull heater core out of heater-blower case, and remove rubber grommets from inlet and outlet fittings.

b. Installation

1. Install rubber grommets on heater core inlet and outlet fittings and position heater core inside of heater-blower case.

2. Position rubber grommets around heater core inlet and outlet fittings where fittings protrude through heater-blower case.

3. Position wire retainer clamps over heater core ends and secure to heater-blower case using four screws, two per retaining clamp.

4. Install heater-blower assembly as described in Note 5b.

7. Ventilation Control Panel (Except 693)

The procedure for removing and installing the Ventilation Control Panel is described in Section 12, Note 57.

AIR CONDITIONING

Automatic Climate Control

The Automatic Climate Control Air Conditioning and Heating System is standard equipment on 1967 Fleetwood Seventy-Five Sedans and Limousines and optional on all other models.

The front compartment systems on Fleetwood Seventy-Five and Eldorado models are modified versions of the standard system. The rear system used on Fleetwood Seventy-Five Sedans and Limousines is covered after the explanation of the standard system. All information pertaining to the standard system also pertains to the Fleetwood Seventy-Five front compartment system and the Eldorado system unless otherwise noted. Procedures pertaining to the Fleetwood Eldorado system only are covered at the end of this section.

Automatic Climate Control permits a constant interior temperature of between 65°F and 85°F to be maintained, regardless of changes in the ambient air temperature, without any assistance from the driver, using the basic air mix heating and an additional air conditioning system that are combined, once the system has been put into operation.

To accomplish this, the control system is composed of five major sections: Three temperature sensors (thermistors) that sense the in-car temperature, the ambient air temperature and the discharge air temperature; a control panel that contains a transistorized amplifier and temperature dial; a transducer that converts an electrical signal into a modulated vacuum supply; the power servo unit that controls the vacuum circuitry to operate the system; and a circuit board in the power servo that controls the operation of the blower.

The remaining major components of the 1967 Cadillac air conditioning system, Figs. 1-5 and 1-6, are the compressor, condenser, dehydrator-receiver, expansion valve, evaporator, suction throttling valve, and blower assembly. These components are all mounted in the engine compartment.

The air conditioner operates on either 100% outside air or a combination of 20% outside air mixed with 80% recirculated air, dependent on the position of the Automatic Climate Control lever and the setting of the Automatic Climate Control System. Outside air for the air conditioner is supplied through the cowl vent, located directly below the windshield on all 1967 Cadillac cars. Inside air is drawn from the passenger compartment by the blower, through the air inlet assembly located behind the right cowl kick pad.

Cooled air is delivered to the passenger compartment through five air outlets in the instrument panel. Two outlets are located at each end of the instrument panel and another at the center.

The vanes in the end outlets can be set to direct air flow in any direction by positioning the knob on each outlet in the direction you wish the air to flow. The end outlets can be closed by moving the knobs toward each other. The center outlet can be closed or set to direct air flow up or down by rotating the vaned outlet.

MAJOR COMPONENTS OF SYSTEM

Automatic Climate Control Components (Fig. 1-5)

a. Sensors

A sensor (thermistor) is a type of resistor whose resistance value varies inversely to temperature. As the temperature rises, the resistance value decreases; as the temperature falls, the resistance value increases.

The in-car sensor, mounted in a grille located on the instrument panel upper cover, senses the temperature of the passenger compartment as well as the sun load on the car.

The duct sensor senses the discharge air temperature. It is located on the heat distributor at the center of the car. A plastic air transfer tube in the air conditioner distributor enables the duct sensor to sense the air conditioner discharge air temperature during air conditioner operation.

The third sensor, the ambient sensor, is located in the air inlet assembly behind the right cowl kick pad on all models except the Eldorado on which it is located at the right end of the cowl. It senses the temperature of the ambient air entering the system.

b. Temperature Dial

The temperature dial, located on the control panel, is graduated in 5°F divisions between 65°F and 85°F, allowing the driver to select any temperature within this range.

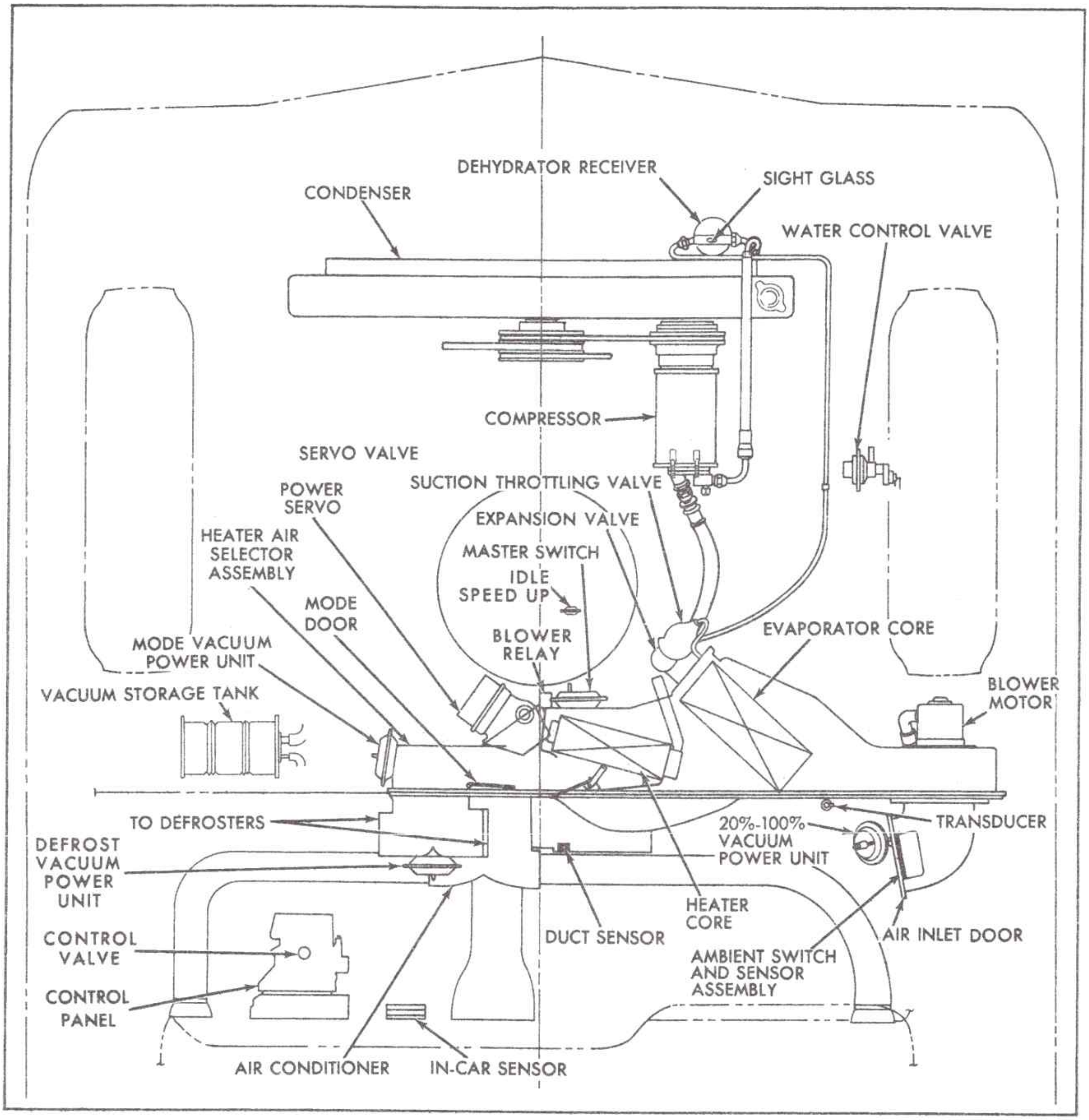


Fig. 1-5 Location of Air Conditioning Components (Except 693 & 697)

The temperature dial is pressed on the shaft of a rheostat. Setting the dial sets the resistance value of the rheostat. This resistance, in series with the resistances of the three sensors, forms a voltage divider network supplying a voltage signal to the amplifier. If any of the sensors detect a change in temperature, or the driver changes the temperature dial rheostat setting, the resultant change in resistance causes a corresponding change in the voltage signal to the amplifier.

c. Amplifier

The amplifier, mounted on the back of the control panel, is a two-stage DC amplifier that provides a voltage output proportional to the input signal from the sensor string. It is constructed of two transistors on a small circuit board, with compensation for temperature or voltage changes provided through the use of resistors.

A protective diode is included, to clip inductive voltage spikes that might otherwise damage components of the amplifier.

When the system is operating, the amplifier changes the input signal from the sensor string to a proportionate DC voltage that controls the transducer.

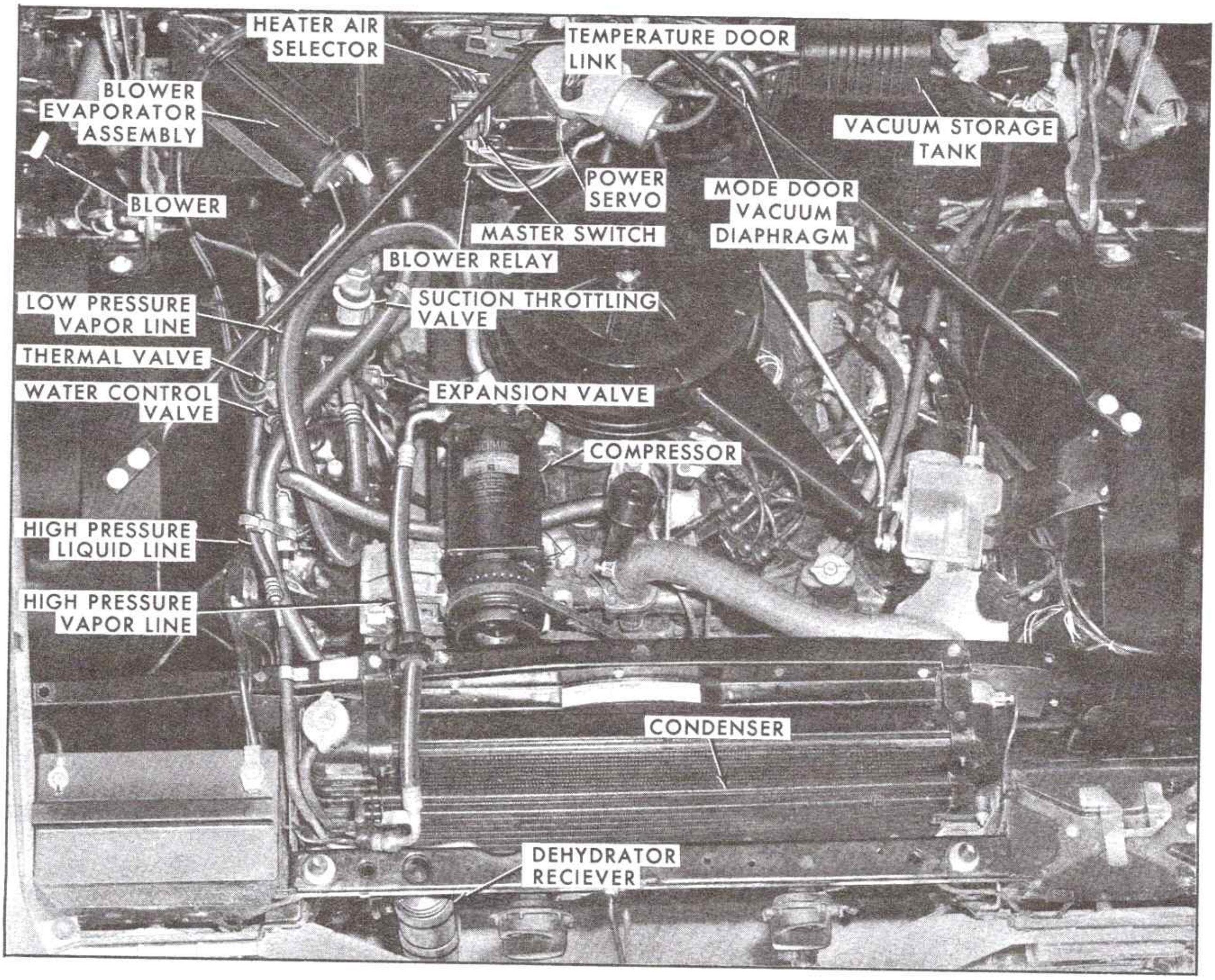


Fig. 1-6 Air Conditioning Under Hood Components on Car (Except 693)

The amplifier is serviced only as an assembly. No attempt should be made to repair it as the calibration of the amplifier cannot be accomplished in the field.

d. Transducer

The transducer, mounted on the right side of the cowl below the instrument panel, is an electro-mechanical device that converts the DC voltage signal from the amplifier to a proportionate vacuum output that controls the power servo unit.

The transducer is constructed of four major parts: the vacuum regulator valve, a wire element, production adjusting mechanism, and a housing. The valve is a force actuated type where output is proportioned to the force applied by the wire element. The wire element is enclosed in a steel tube housing that provides rigidity as well as protection from air currents.

During periods when the amplifier is supplying a weak electrical signal, or none at all, the wire element contracts, allowing a large amount of vacuum flow to the power servo unit. When the amplifier emits a stronger signal, the wire element is heated and expands, thereby diminishing the vacuum flow to the power servo unit.

e. Power Servo Unit

The power servo unit is mounted on the left side of the heater-air selector assembly located

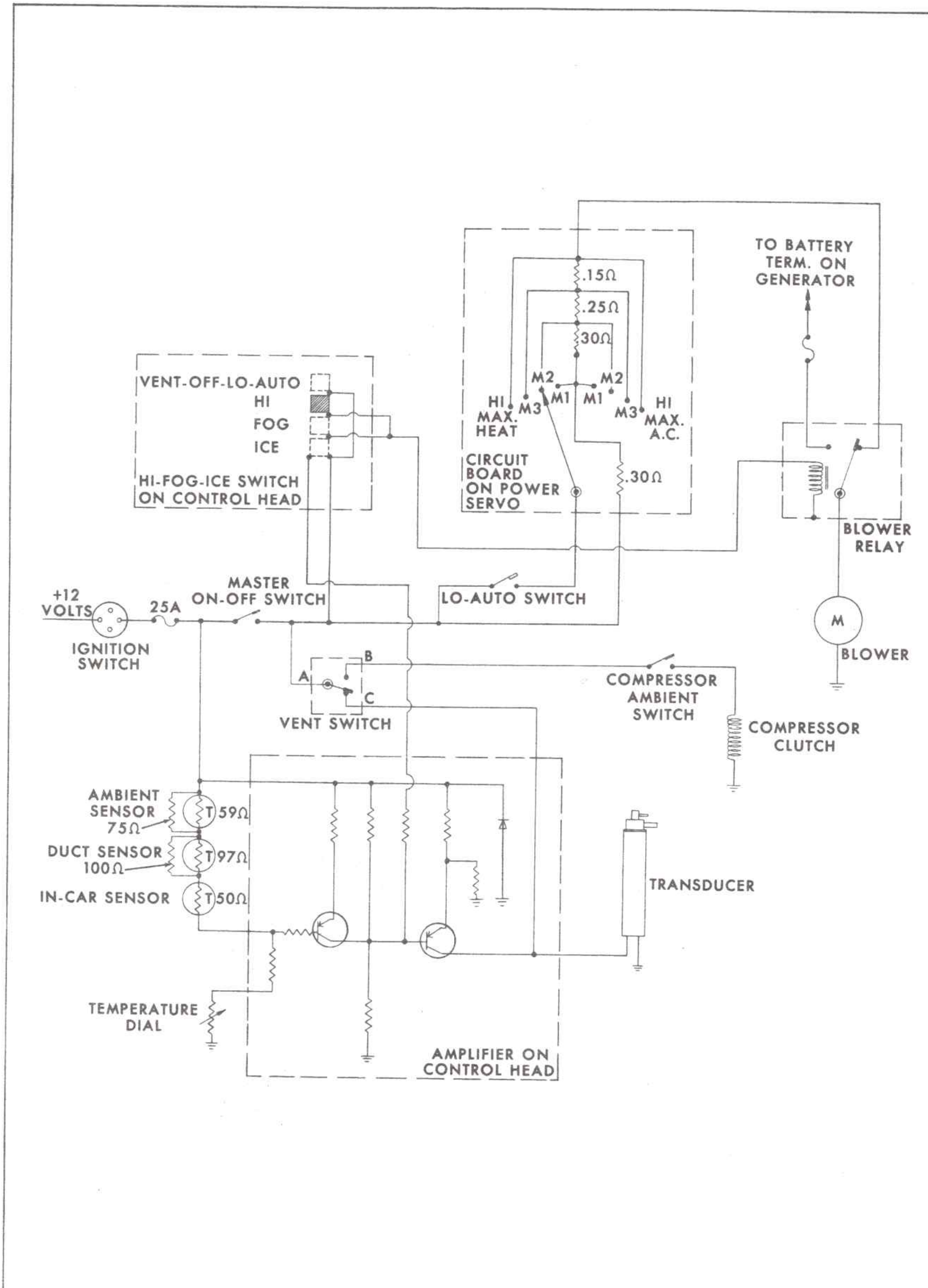


Fig. 1-7 Automatic Climate Control Electrical Schematic (Except 697)

in the engine compartment. It is composed of four basic parts; a vacuum diaphragm assembly, an electrical circuit board, a rotary vacuum valve, and a door link attached to the temperature door.

The vacuum diaphragm is connected to a pivot arm, and positions the pivot arm in response to the regulated vacuum output from the transducer. The pivot arm actuates the temperature door, the rotary vacuum valve and the circuit board.

The temperature door controls the proportions of cooled and heated air that are mixed to provide the proper discharge air temperature.

The rotary vacuum valve provides the necessary control for the operation of the various vacuum-operated units in the system.

The electrical circuit board controls the blower speeds through the use of resistors.

Compressor (Fig. 1-8)

The 1967 Cadillac uses a six-cylinder axial type refrigerant compressor. The compressor is made up of three double-acting pistons mounted axially around the compressor shaft, each of which operate in a front and rear cylinder assembly. The pistons are actuated by a swash plate that is pressed on the compressor shaft.

The cylinders have a bore diameter of 1-1/2 inches and a stroke of 1-3/16 inches, providing a total piston displacement of 12.6 cubic inches.

When the selector lever is moved from the OFF position, with the ambient air temperature above approximately 32°F, the electrical circuit to the compressor clutch is closed when the master switch closes. Current flowing through the coil creates a magnetic force that draws the armature plate (which is ahead of the pulley assembly) rearward toward the pulley. As the armature plate moves toward the pulley it contacts the pulley face, which is rotating freely on the compressor front head.

The magnetic force locks the armature plate and pulley together as one unit. The compressor shaft then turns with the pulley, providing the compressor pumping action needed to operate the system.

When the selector lever is moved to the OFF position, the armature plate hub actuating springs move the armature plate away from the pulley.

If the air conditioning system was in use when the engine was turned off, the armature plate may remain in contact with the pulley due to residual magnetism. This will cause no trouble, as the armature plate and pulley will separate as soon as the engine is started.

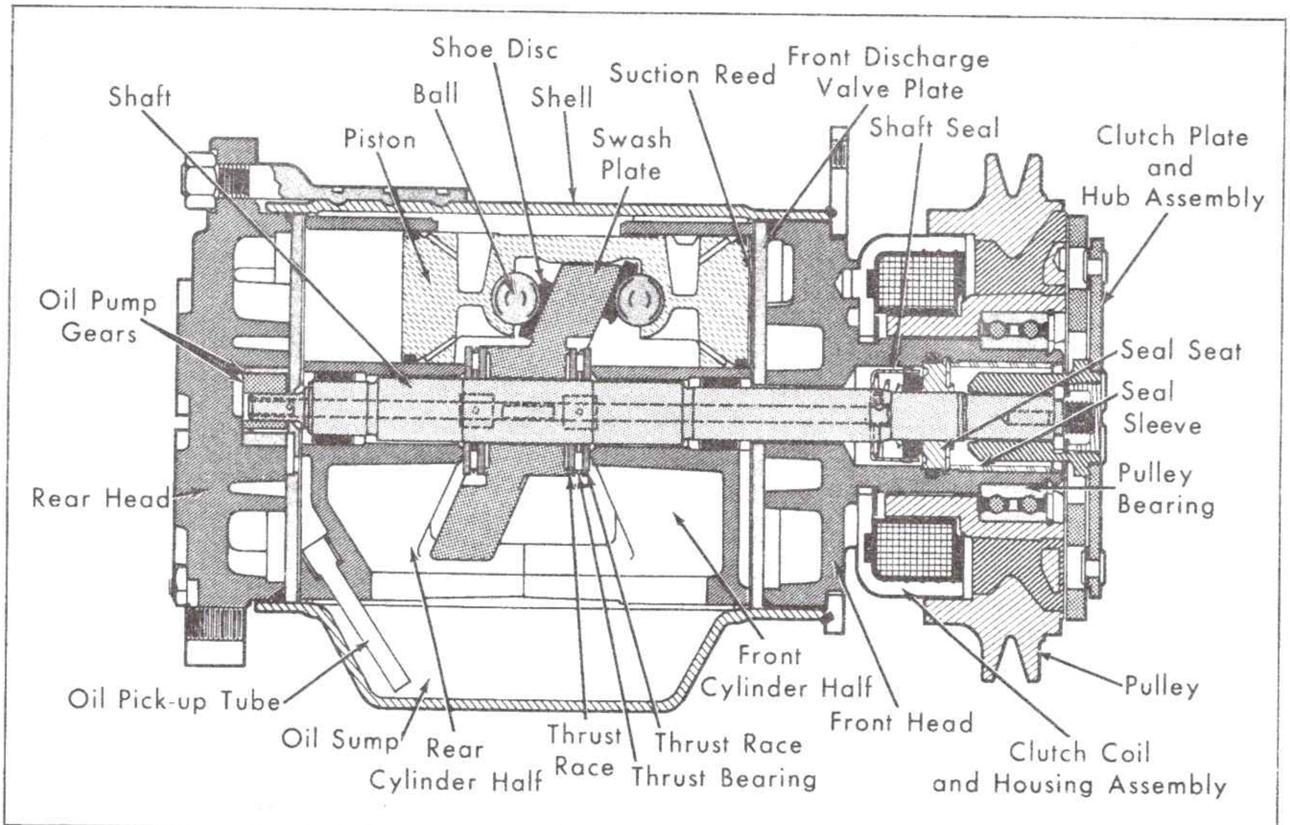


Fig. 1-8 Air Conditioning Compressor Cross Section

Suction Throttling Valve (Fig. 1-9)

The pilot operated absolute (POA) suction throttling valve is located on the front of the evaporator assembly, Fig. 1-10, in the low pressure line to the compressor. The valve body contains three ports; the evaporator gage port on the inlet side of the valve, and two ports on the outlet side for the external equalizer line and the oil bleed line.

The POA suction throttling valve is used to maintain evaporator pressure at a particular setting, 29 ± .5 psi. The valve is controlled in operation by opposing forces on the valve piston: evaporator pressure on one side of the piston is opposed by spring pressure and control pressure on the other side.

When evaporator pressure rises above the setting, this pressure is exerted against the piston and, by means of a small bleed hole in the piston, into the bellows chamber, where it is reduced to control pressure by the bellows-operated pilot needle valve. This evaporator pressure overcomes both the spring pressure and control pressure, causing the piston to open until a balanced position is reached, at which evaporator pressure returns to the setting desired.

When evaporator pressure drops below the setting, spring pressure overcomes evaporator pressure, causing the piston to close down until the evaporator pressure reaches the setting desired.

The POA suction throttling valve is designed to maintain a constant evaporator pressure of 29 psi. This design is permitted by the air-mix system in which the temperature door, Fig. 1-14, regulates the temperature of the air discharged into the passenger compartment.

Evaporator pressure is maintained at 29 psi in order to keep the temperature of the core from dropping below 32°F. This prevents condensation on the core from freezing and blocking the air flow through the core.

Expansion Valve

An externally equalized expansion valve is mounted on the bottom front of the blower-evaporator assembly just below the suction throttling valve, Fig. 1-10.

The expansion valve can be described as a temperature and pressure sensitive refrigerant control valve. At the orifice (or restriction) of the valve, high pressure liquid refrigerant changes to a low pressure liquid and enters the evaporator core.

The expansion valve regulates the flow of refrigerant through the evaporator core. It is preset at the factory and is not adjustable.

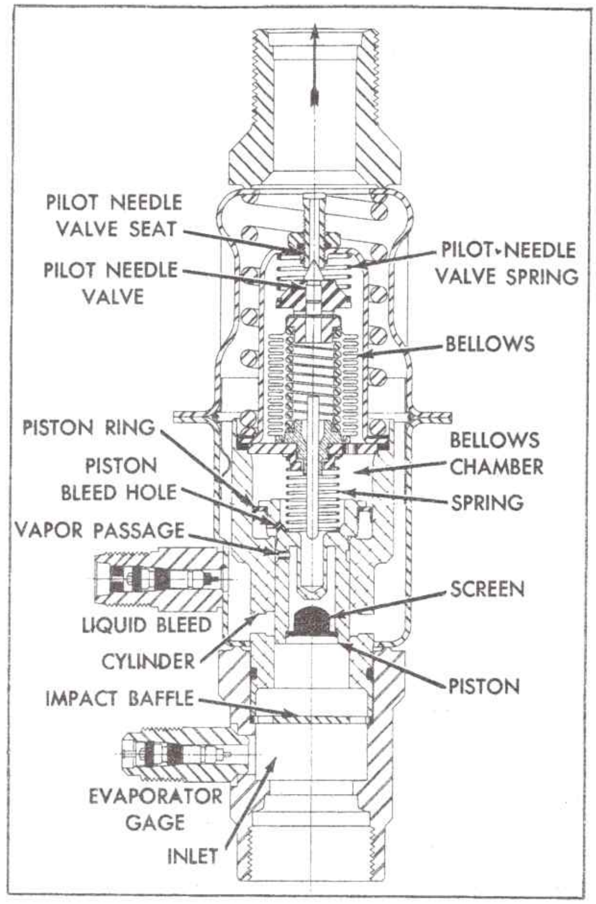


Fig. 1-9 Suction Throttling Valve Cross Section

Oil Bleed Line

The oil bleed line runs from the bottom tank of the evaporator core to the outlet side of the POA suction throttling valve.

This line is used in the system to protect the compressor during periods of low refrigerant charge. Under normal charge conditions, this line has no active use, as the compressor obtains an adequate oil supply.

With a partially depleted refrigerant charge, any excess oil and refrigerant mixture will flow from the bottom tank of the evaporator core through the oil bleed line to the compressor outlet on the POA suction throttling valve. The oil is then carried to the compressor through the low pressure line. This oil flow prevents any oil deficiencies in the compressor that could arise during periods of low refrigerant charge, or low evaporator pressure.

CAUTION: During periods of zero charge, no refrigerant is available to carry oil back to the compressor. Do not operate a completely discharged system, as compressor seizure might occur.

A check valve is used in the oil bleed line at the port connection on the suction throttling valve. This check valve opens at 5 psi differential pressure across the valve, and is fully open when the differential pressure exceeds 12 psi. Below the 5 psi differential, the check valve is closed to prevent capacity loss. This feature prevents refrigerant by-passing the evaporator during traffic conditions when cooling demands are greatest.

Condenser

The condenser is an aluminum heat transfer unit similar in appearance to the radiator, and located in front of the radiator assembly.

The function of the condenser is to transfer the heat picked up by the refrigerant to the air stream passing through the condenser core. In the condenser, high temperature vapor is cooled by outside air and converted back to a liquid. This liquid refrigerant then collects in the dehydrator-receiver and is available for further use in the evaporator core when required.

Dehydrator-Receiver

The dehydrator-receiver is an aluminum tank 3 inches in diameter, having a cloth sack filled with a moisture-absorbing material or desiccant. It is located on the right front side of the condenser. The sight glass, used to determine refrigerant charge in system, is an integral part of this assembly.

The receiver acts as a reservoir for refrigerant and the desiccant removes moisture that may have entered the system.

Evaporator

The evaporator is located on the right side of the cowl, Fig. 1-10.

The evaporator case is constructed of plastic and contains an aluminum core. The core is the container for the liquid refrigerant, so designed that it can readily absorb heat from the surrounding air. It is similar in construction to the car radiator.

The core is made of aluminum tubes that pick up heat from the air and transfer this heat to the refrigerant. The tubes are spaced closely together to provide maximum surface area.

Liquid refrigerant is metered into the core through an inlet pipe at the bottom of the core. This inlet pipe serves to distribute an equal amount of liquid refrigerant to each tube of the core. The core in the evaporator is the actual cooling unit of the system. This is the only place in the system where refrigerant is intended

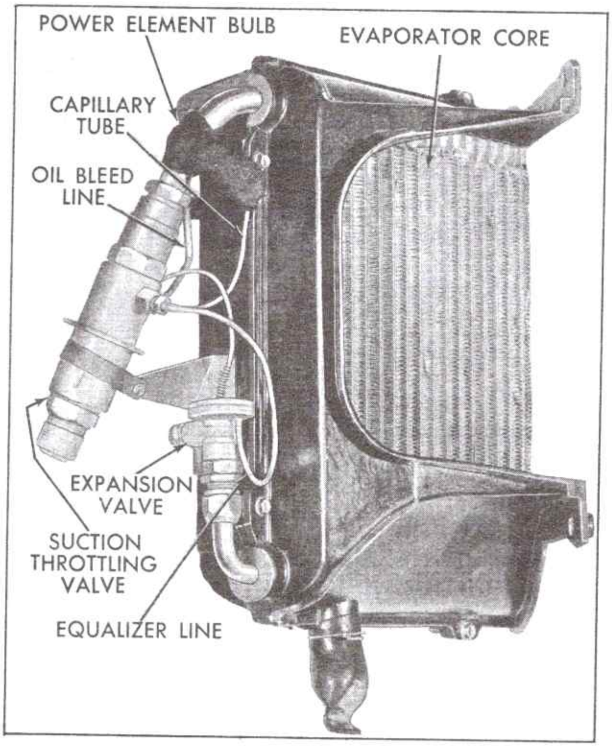


Fig. 1-10 Front Evaporator Assembly

to change from a liquid to a vapor state. Warm air passing through the core is cooled before being discharged into the passenger compartment.

Blower Assembly

The blower assembly is mounted on the front right side of the cowl. The blower motor has six speeds: low, medium low, medium, medium high, high, and a super high which are governed by resistors. The resistors are part of the power servo unit located on the left top side of the heater-air selector assembly in the engine compartment. The blower motor is air cooled by the blower's own output. A tube between the blower case and the blower motor allows part of the blower output to pass through the motor case and exhaust through an opening on the opposite side of the motor. A rubber tube at the exhaust prevents dirt and moisture from entering the motor.

The blower assembly draws outside air in through the cowl vent, or air from the passenger compartment through an opening behind the right cowl kick pad.

Control Panel

The Automatic Climate Control system control panel, Fig. 1-11, is located below the instrument cluster to the right of the ignition switch. The panel consists of a temperature dial and a single horizontal sliding lever.

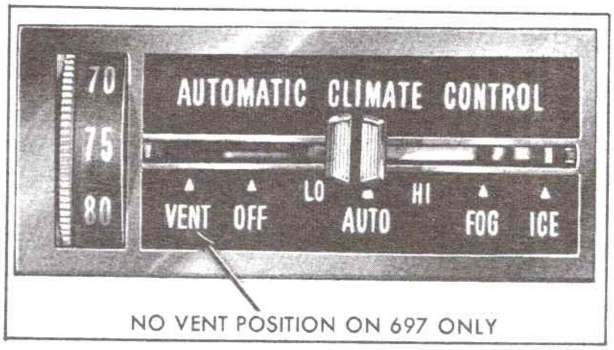


Fig. 1-11 Front Control Panel

The temperature dial can be rotated up or down to select any interior temperature, at breath level, between 65° and 85°F.

When the sliding lever is moved to the AUTOMATIC position the Automatic Climate Control System is turned to normal operation. The heating, air conditioning, and blower speeds are automatically controlled to bring the temperature of the passenger compartment up, or down, to the setting of the temperature dial. In cold weather operation, the air inlet door remains closed and the blower OFF, until the engine coolant is warm enough to provide heat to the incoming air.

When the lever is moved to the LO position, operation is basically the same as described above. However, the Lo-Auto switch is opened, causing current to the blower to flow through all resistors on the power servo circuit board, Fig. 1-7. This action causes the blower to operate at a fixed LOW speed.

When the lever is placed in the HI position, the operation is again basically the same as above. However, the power servo circuit board, Fig. 1-7 is by-passed by the blower relay and the blower operates only at SUPER HIGH speed. Also, the internal connections of the rotary control vacuum valve are changed, Fig. 1-12, allowing the system to operate on 80% recirculated and 20% outside air in maximum air conditioning position.

Placing the lever in the FOG position causes the discharge air to be directed to the windshield. To insure that the air will be directed to the windshield, the rotary control vacuum valve connections are changed, Fig. 1-12, so that all air flow will be through the heater ducts. The temperature of discharge air and blower speed are controlled by the power servo.

Moving the lever to the ICE position results in operation like that in FOG. However, the power servo is locked in the full heat position to insure warm air discharge at all times. The power servo circuit board is by-passed by the blower relay to provide a fixed SUPER HIGH blower speed.

On all models except the Fleetwood Seventy-Five a VENT position is provided to the left of OFF. Placing the selector in this position causes outside air to be discharged from the air conditioning outlets. This is accomplished by locking the power servo in the full air conditioning position and opening the circuit to the compressor clutch. To insure air flow through the system, the Lo-Auto switch is opened, causing the blower to operate at a fixed LOW speed. No heating or cooling of the air will take place.

Vacuum Circuit

The Automatic Climate Control system incorporates two basic vacuum circuits. The first circuit controls the position of the power servo unit, and the second circuit controls the operations of the various vacuum operated components of the system.

Vacuum flows from the engine through the vacuum storage tank to the transducer. The vacuum, now regulated by the transducer, then flows to the power servo unit.

The second vacuum circuit flows from the engine through the check valve to the control valve and from there to the servo vacuum valve. To trace the path of the vacuum, refer to the Control and Servo Valve Connections, Fig. 1-12 and Fig. 1-13. The restrictor provides a time delay to allow the power servo unit to position itself before vacuum is supplied to the rotary vacuum valve.

Vacuum also flows through the neutral safety switch to control the operation of the idle speed-up device.

Operation

a. Off (Fig. 1-14)

NOTE: For the purpose of this discussion assume the control lever is in the OFF position, and the engine is running.

Whenever the engine is operating, the sensor string is transmitting a signal to the amplifier. The signal is converted to a proportionate DC voltage by the amplifier, and is fed to the transducer. The transducer converts the electrical signal to a proportionate regulated vacuum output that is supplied to the vacuum power unit of the power servo, thus placing the power servo unit in the proper operating position, if the system were to be started.

b. Maximum Cooling (Fig. 1-15)

NOTE: For the purpose of the discussion assume the ambient air temperature is 90°F, the in-car temperature is 90°F, the temperature dial rheostat is set at 75°F, and the engine is running.

Due to the high temperatures acting on the sensors, the resistance values of the sensors will be low, causing a strong signal to the amplifier. The output of the amplifier is high, and

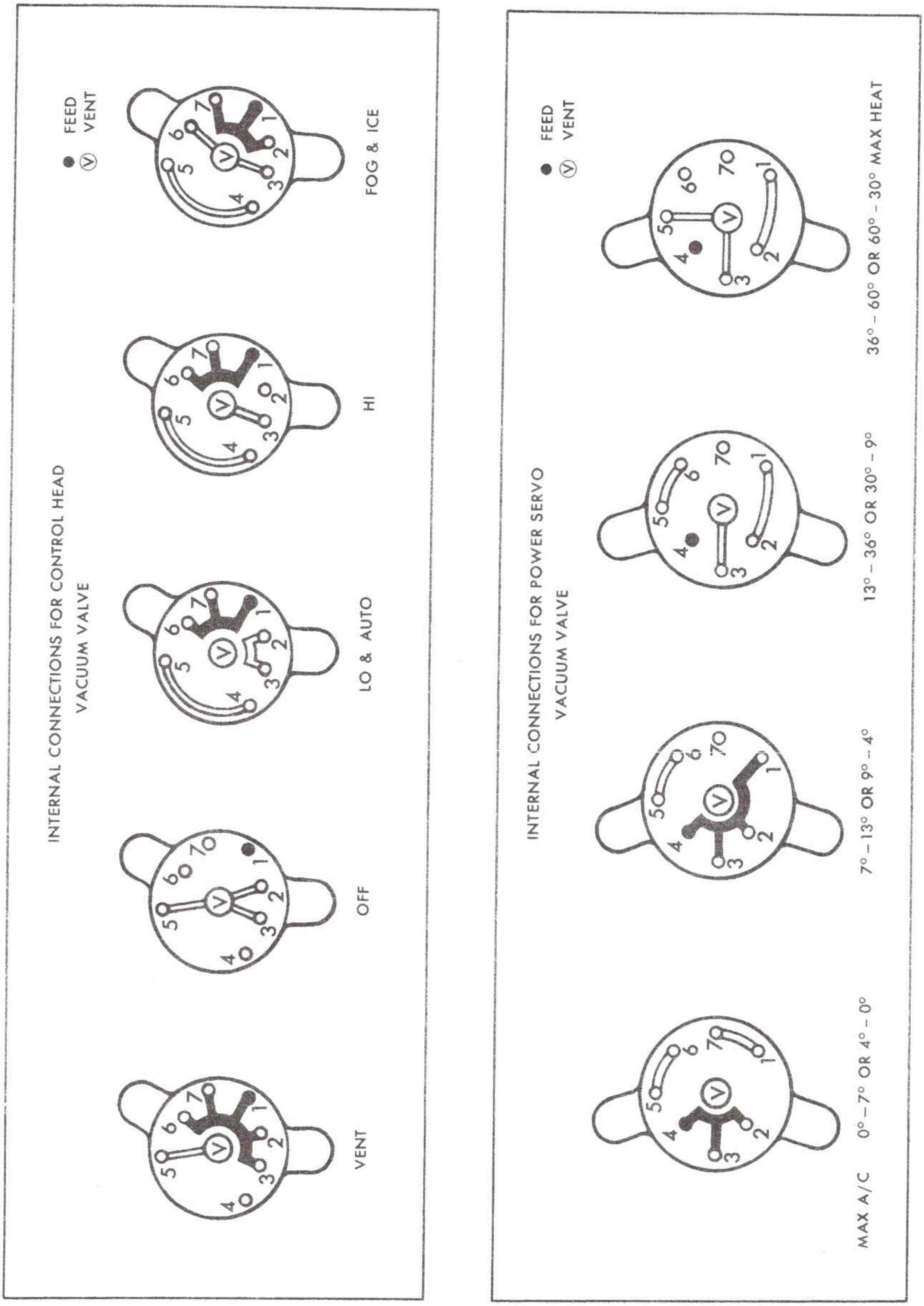


Fig. 1-12 Rotary Vacuum Valve Internal Connections

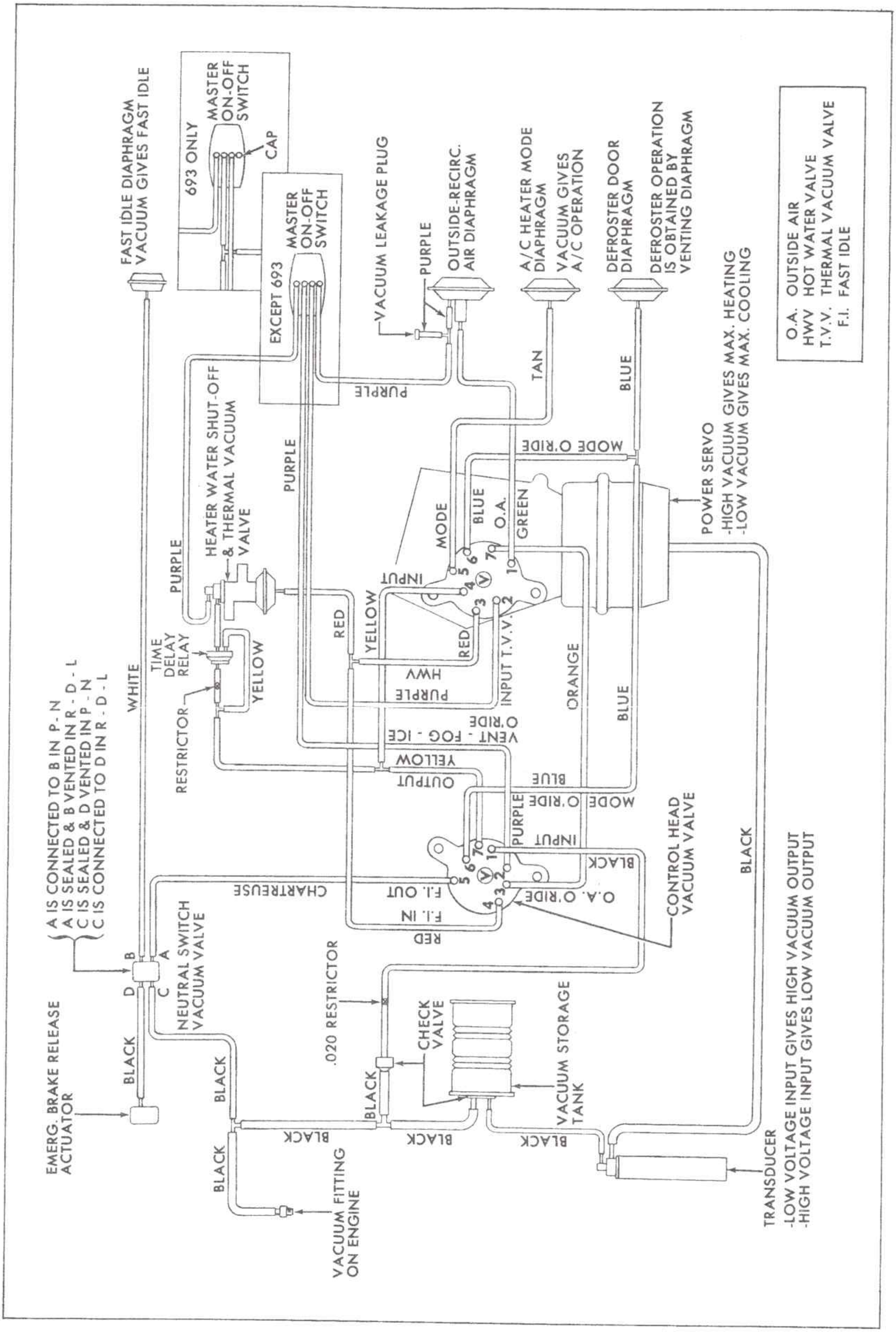


Fig. 1-13 Automatic Climate Control Vacuum Schematic

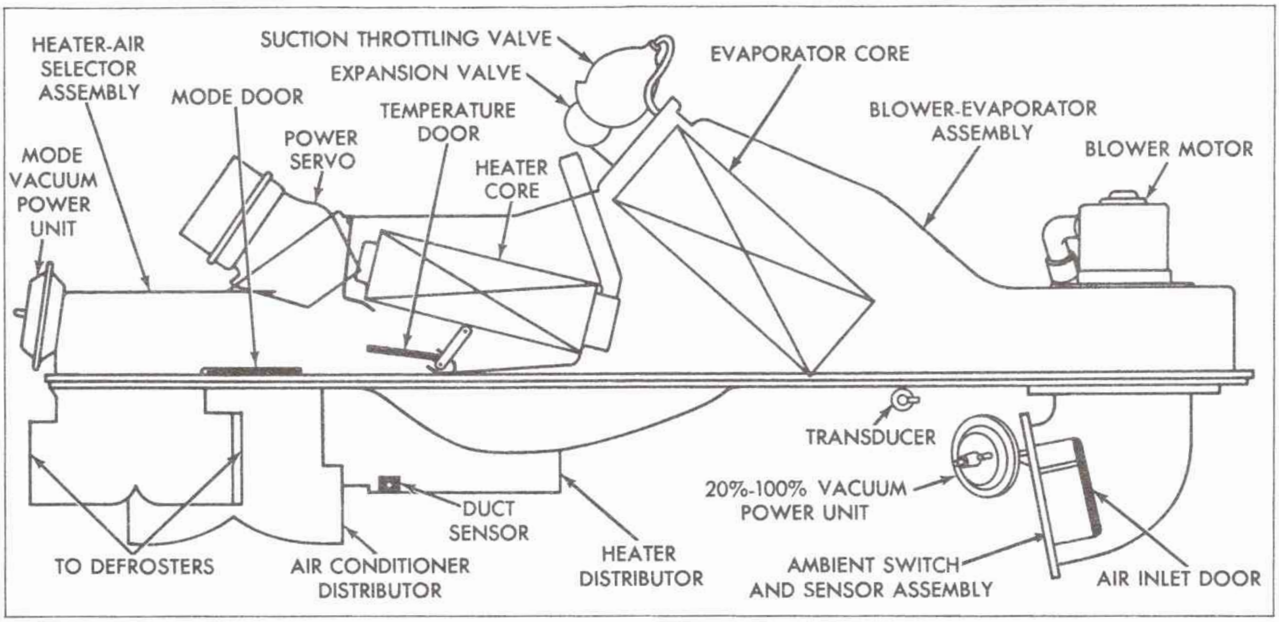


Fig. 1-14 Automatic Climate Control Operation - Off

is being fed to the transducer, where it is converted to a weak vacuum output, which in turn causes the power servo to be in the maximum air conditioning position.

When the lever is placed in the AUTOMATIC position, vacuum is fed through the control vacuum valve to the master switch, completing the electrical circuit to the blower motor and compressor, and to the servo vacuum valve. In the maximum air conditioning position, the servo valve performs the following valve functions:

The mode door is moved to the air conditioning position, allowing the discharge air to be discharged through the air conditioning outlets. The water control valve is closed, preventing the flow of engine coolant to the heater core. The outside air door, because of the internal connections of the control vacuum valve, is admitting only outside air into the system, even though the servo valve is set for recirculated air. The idle speed-up device will engage any time that the transmission is placed in PARK or NEUTRAL.

In addition, the power servo has placed the temperature door in the maximum cooling position, preventing any air flow through the heater core. The blower is operating at HIGH speed.

As the system operates, the in-car and duct sensors -- sensing the lower temperatures -- increase resistance, causing more vacuum to be fed to the power servo unit. The power servo then

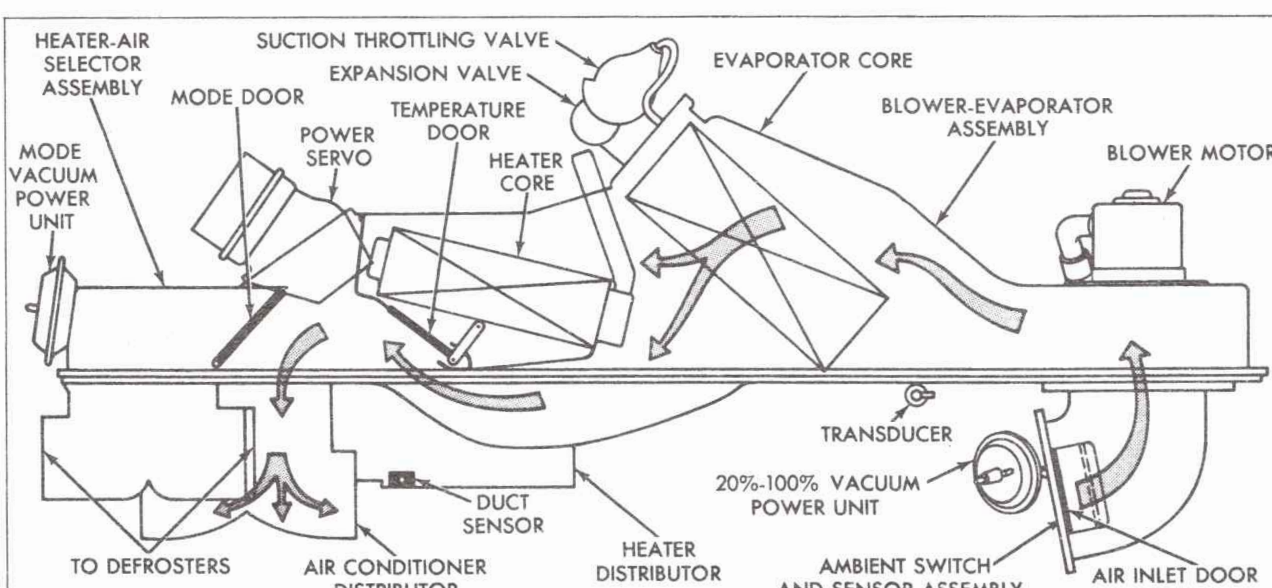


Fig. 1-15 Automatic Climate Control Operation - Max. Cooling & Vent

performs the necessary events, in the proper sequence, Fig. 1-16, until such time as the system reaches a balanced position to hold the interior temperature to the dial setting.

As the vacuum supplied to the power servo vacuum power unit increases, the position of the operating arm and the servo vacuum valve changes. The servo valve now calls for outside air. The blower decreases to M3 speed. Vacuum to the hot water valve is cut off, causing the hot water valve to pass engine coolant.

As the system continues to modulate, the blower will decrease to M2 speed and then the position of the temperature door will change to allow the entry of heated air that will mix with the cooled air. Continued modulation by the system can decrease the blower to M1 speed. The system will modulate itself to maintain the interior temperature, regardless of any change in the ambient air temperature.

If the ambient air temperature were to fall quite rapidly, the ambient sensor resistance value would increase, causing a weaker voltage signal to be sent to the transducer. The power servo unit would move towards the heater position as the vacuum output from the transducer was increased. The system would switch into the heater mode and the blower speed would increase to M2, then, M3 and HIGH. During the increase of blower speeds, the temperature door would be traveling towards the maximum heat position and eventually would prevent all cold air from entering the system.

With the control lever placed in the HI position, the operation of the system is basically the same as described above. However, the electrical circuit board, Fig. 1-7, is by-passed, causing the blower to operate continuously at SUPER HIGH speed. In addition, the internal connections of the control vacuum valve are changed, allowing the entry of 80% recirculated air and 20% outside air into the system during maximum air conditioning operation.

In the LO position the Lo-Auto switch is opened, causing the blower to operate at a fixed LOW speed.

Power Servo Arm Angle		Event
Increasing Vacuum	Decreasing Vacuum	
7°	4°	Change Air Source Recirc —— Outside
7°	4°	Change Blower Speed High —— M-3
13°	9°	Idle Speed-Up Device Available —— Off
13°	9°	Water Control Valve Closed —— Open
13°	11°	Change Blower Speed M-3 —— M-2
18°	18°	Temperature Door Full Cold —— Blends
19°	17°	Change Blower Speed M-2 —— M-1
36°	30°	Change Mode A/C —— Heat
51°	48°	Change Blower Speed M-1 —— M-2
55°	52°	Change Blower Speed M-2 —— M-3
59°	57°	Change Blower Speed M-3 —— High
60°	60°	Temperature Door Blending —— Full Heat

Fig. 1-16 Sequence of Events

c. Maximum Heat (Fig. 1-17)

NOTE: For the purpose of this discussion, assume the ambient air temperature is 0°F, the in-car temperature is 0°F, the temperature dial is set at 75°F, and the engine is running.

Due to the low temperatures acting on the sensors, their resistance values will be high, causing a weak signal to the amplifier. The output of the amplifier is low, and is being fed to the transducer, where it is converted to a strong vacuum output causing the power servo to move toward the maximum heat position.

When the lever is placed in the AUTOMATIC position, the restrictor in the vacuum line, Fig. 1-13, prevents vacuum from reaching the servo vacuum valve until the power servo has reached the heat mode. In the heat mode, the vacuum circuitry is such that the vacuum must pass through the thermal vacuum valve in order to actuate the master switch. The compressor clutch circuit is held open by the ambient switch any time it is below 32°F.

Once the engine coolant has reached the temperature of approximately 120°F, vacuum flows through the thermal vacuum valve, causing the outside air door to open and the blower to operate at HIGH speed, admitting heated air into the car. The in-car and duct sensors sense the temperature rise and, as their resistance values lower, the system begins to modulate and the blower speeds will diminish to M3, M2, and then to M1. During the decrease in blower speeds, the temperature door would travel from the maximum heat position to a mid-position, blending heated and cooled air. If the outside air temperature were to rise to about 35°F, the compressor clutch circuit would close, causing compressor operation to begin. Continued temperature increases, sensed by the sensors, cause the system to move toward the air conditioning position.

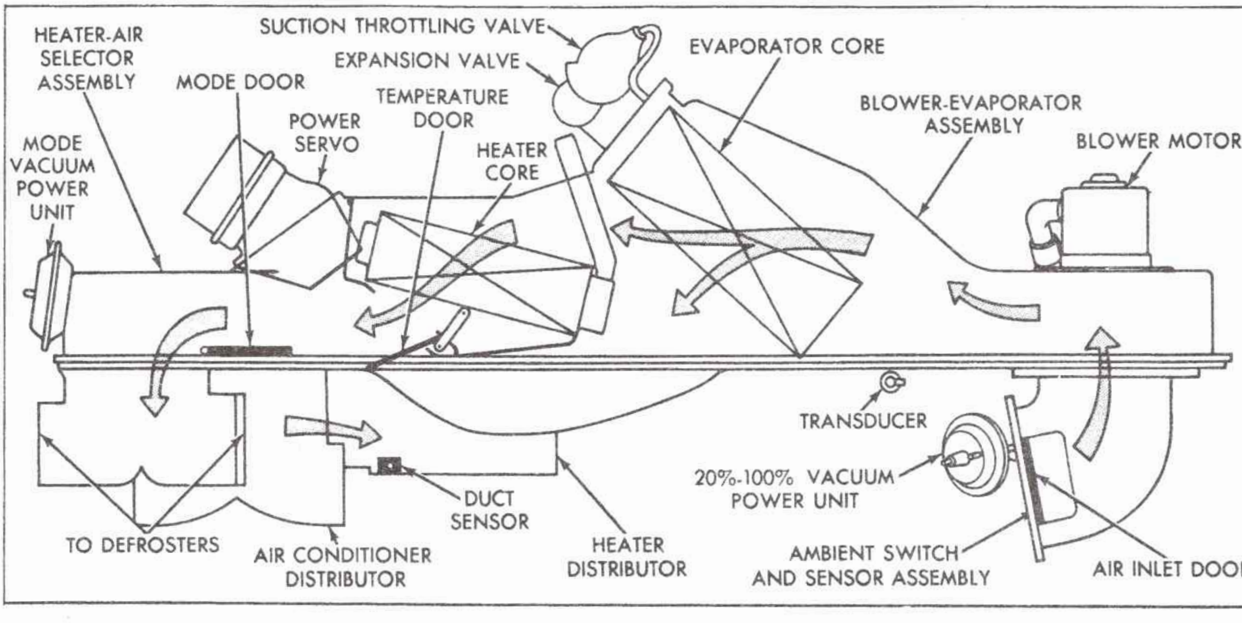


Fig. 1-17 Automatic Climate Control Operation - Max. Heat

The operation of the system, when the lever is placed in HI position is identical to the fore-going description. However, the electrical circuit board, Fig. 1-7, is by-passed by the blower relay, causing the blower to operate continuously at SUPER HIGH speed.

In the LO position the Lo-Auto switch is opened, causing the blower to operate at a fixed LOW blower speed.

d. Ventilation (Fig. 1-15) (Except Fleetwood Seventy-Five)

In the VENT position the Vent switch opens the compressor circuit while closing the vent contacts. Opening the compressor circuit keeps the compressor clutch from energizing. Closing the vent contacts supplies a 12-volt feed to the transducer, driving the system to the full air conditioning position, Fig. 1-15. With the compressor not energized and the system in the full air conditioning mode, outside air will be discharged through the system into the car by the air conditioning outlets.

The Lo-Auto switch is opened in the VENT position, causing the blower to operate at a fixed LOW speed for positive air circulation.

Electrical Circuit (Figs. 1-18 and 1-19)

In the Automatic Climate Control electrical circuit, current flows from the accessory terminal of the ignition switch to the 25 ampere fuse on the fuse block. The current then flows to the amplifier on the control panel, to the ambient sensor and to the master switch. When the master switch closes, the current flows to the Hi-Fog-Ice switch on the control panel.

The ignition switch provides a feed to the compressor switch or transducer through the vent switch depending upon the position of the

Selector Position	Master Switch	Hi-Fog-Ice Switch	Lo Auto Switch	Vent Switch	Ambient Switch	Blower Relay	Transducer
Vent*	On	Off	Open	Vent	Open below 28°F, closed above 35° in all selector positions.	N.C.**	A/C
Off	Off	Off	Open	Vent		N.C.	A/C
Lo	On	Off	Open	Compressor		N.C.	Variable
Auto	On	Off	Closed	Compressor		N.C.	Variable
Hi	On	Hi	Closed	Compressor		N.O.***	Variable
Fog	On	Fog	Closed	Compressor		N.C.	Variable
Ice	On	Ice	Closed	Compressor		N.O.	Heat

* Except Fleetwood Seventy-Five
** N.C. - Normally Closed Contacts
***N.O. - Normally Open Contacts

Fig. 1-18 Electrical Operation

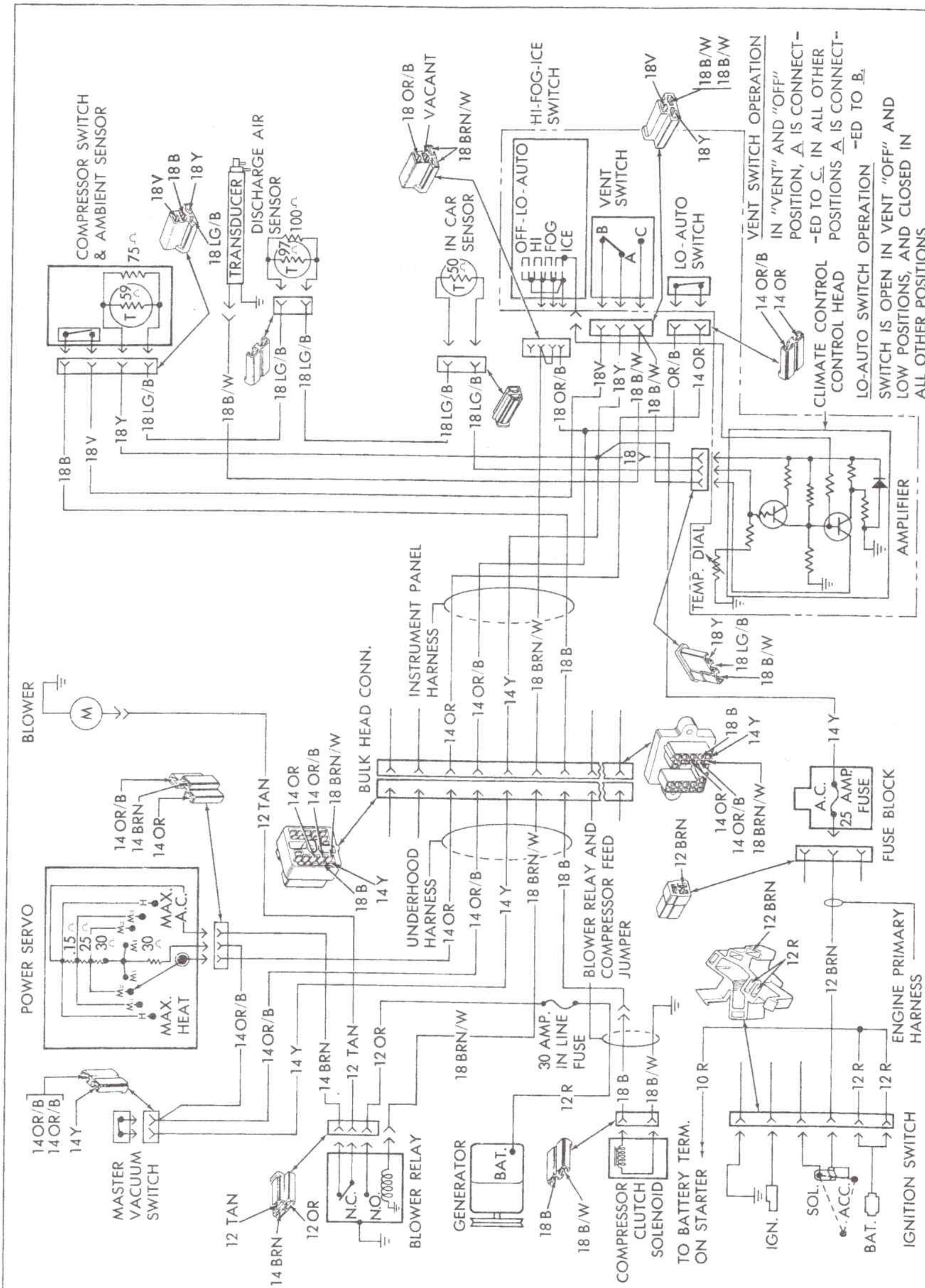


Fig. 1-19 Automatic Climate Control Circuit Diagram (Except 693 & 697)

selector lever, except on 697 model which has no Vent position. Another feed is provided to the lo position of the power servo circuit board or the movable contact in the power servo. The feed to the movable contact in the power servo must pass through the Lo-Auto switch on the control panel.

Cycle of Operation (Fig. 1-20)

The refrigerant compressor, belt-driven by the engine, furnishes the pumping action necessary to operate the air conditioning system. When the control system is set for air conditioning, and the engine and compressor are operating, low pressure vapor is drawn into the compressor where it is compressed to a high pressure, high temperature vapor and forced into the condenser, which is located in front of the radiator. In the condenser, the vaporized refrigerant changes to a high pressure, high temperature liquid as its latent heat escapes to the lower temperature air drawn through the condenser by the engine fan.

This high pressure liquid from the condenser is then forced into the receiver tank, where the last of the bubbles condense so that they will not pass through the system. From the receiver, the liquid flows through the sight glass and the high pressure liquid line to the expansion valve on the evaporator assembly.

The high pressure liquid changes to a low pressure liquid and vapor as it forces its way through the expansion valve into the inlet pipe of the evaporator. The refrigerant is then distributed to the tubes of the evaporator core.

Meanwhile, warm outside air is forced through the evaporator core by the blower fan. Some of the heat from this air is given up to the cold tubes of the evaporator core and into the liquid refrigerant, causing the refrigerant to vaporize. This vapor flows through the suction throttling valve and large diameter low pressure line back to the compressor, where the cycle is repeated.

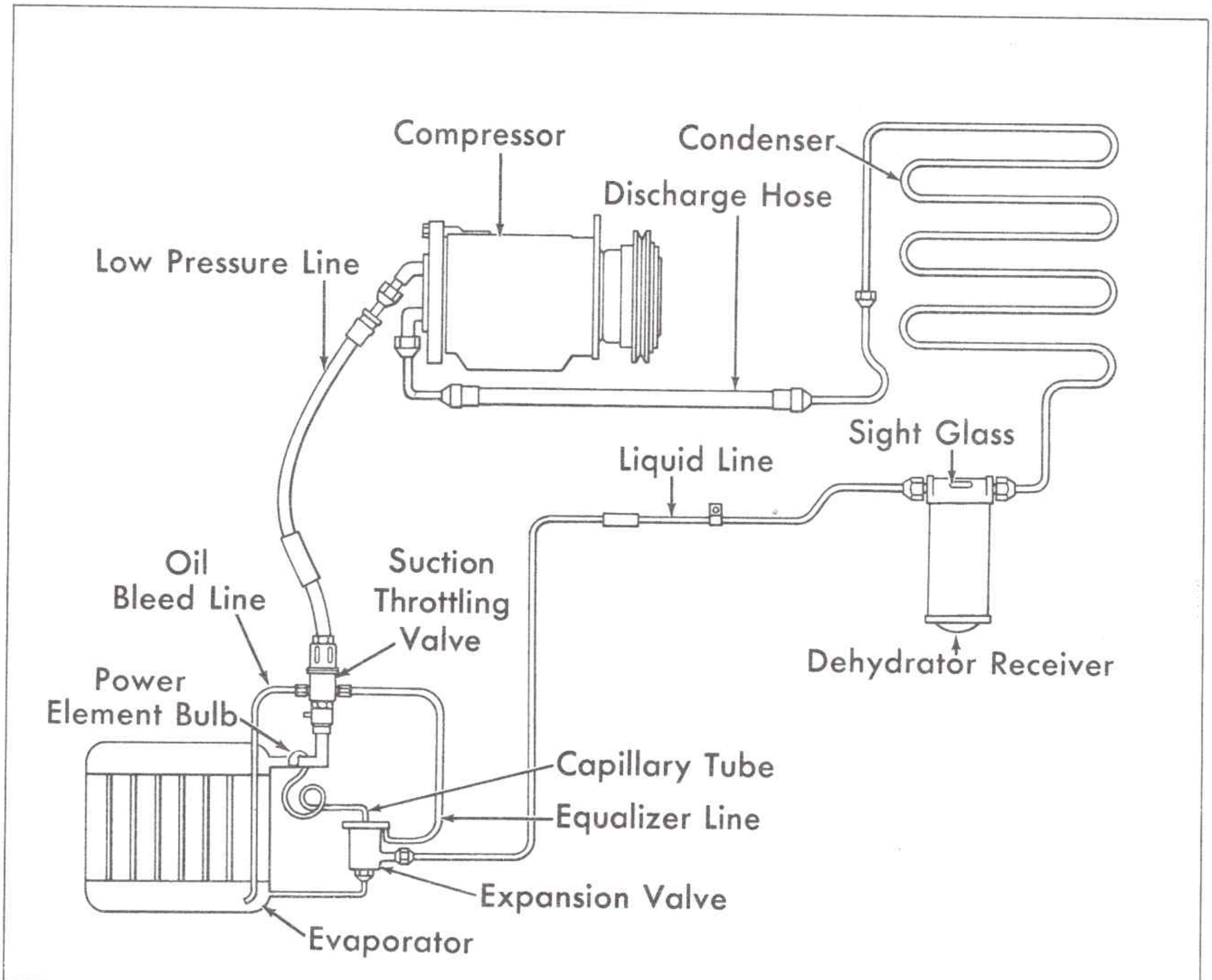


Fig. 1-20 Cycle of Operation

SERVICE INFORMATION

8. Differences in Air Conditioner Equipped Cars

Cadillac cars equipped with an air conditioner incorporate special engineering features to compensate for the extra weight, power requirements, and electrical loads demanded by the air conditioner system. The following features should be kept in mind when working on air conditioned cars:

a. Fan Shroud

A fan shroud is utilized to assist in drawing air through the entire radiator core when engine is at idle.

b. Fan Assembly

A six-bladed aluminum fan is used to provide more air flow and a thermostatically controlled limited-slip clutch is used to reduce fan noise.

c. Radiator Assembly

A special radiator is used with additional copper tubing for better cooling.

d. Power Steering Pump Pulley

A single sheave pulley is used on air conditioned cars.

e. Fuel Filter and Vapor Return Line

A vapor return line is connected from the fuel filter to the fuel tank to reduce the possibility of vapor lock.

f. Generator

A 55 ampere generator is used to accommodate the greater electrical load. Double belts and a two sheave pulley are used on 693 to provide a proper amount of belt wrap on both the compressor and generator.

g. Generator Mounting

A generator adjusting link is mounted on the air conditioner compressor front mounting bracket to aid in adjusting generator belt tension (except 693).

h. Differential Ratio

A higher performance differential ratio is used on cars equipped with air conditioning (except 693).

i. Suspension

Front coil springs have higher static load rate to compensate for additional weight of the system's components (except 693).

j. Water Outlet Pipe

A special water outlet pipe with built-in bosses is used to support forward portion of compressor on air conditioned cars (except 693).

k. Carburetor

An idle speed-up control is used to boost engine rpm when transmission is in NEUTRAL or PARK and the air conditioner is turned ON. This improves engine cooling and air conditioner performance when car is standing.

l. Spark Advance

The vacuum supply to the distributor spark advance on 693 and 697 cars equipped with air conditioning is thermostatically controlled. Two vacuum supplies are provided and these supplies are switched by a valve that is sensitive to radiator coolant temperature. This is done to insure proper idle advance on these cars no matter how warm or cold they may be running.

9. Service Precautions

a. Handling Refrigerant 12

Refrigerant 12 is stored and shipped as a liquid under pressure contained in heavy metal drums in 10, 25, and 145 pound sizes. Correctly handled, it is as safe as compressed air. Incorrectly handled, it can explode and cause serious damage.

In handling refrigerant drums, always observe the following safety precautions.

1. Do not leave drum uncapped if drum is so equipped. The metal cap furnished with the drum when it is shipped is to protect the valve in case the drum is accidentally knocked over. This eliminates the possibility of the drum flying through the shop and causing serious damage to people and property. A safety plug is provided on the valve in case the temperature exceeds the safe limits of the drum. The cap is designed so that if the safety plug at the valve should blow, the refrigerant will escape without causing the drum to move.

2. Do not overfill drum. A safety plug is provided in case the temperature of the refrigerant

exceeds the safe limits of the drum. However, if the drum is overfilled, the pressure created could cause the drum to explode before the temperature rises to the point where the safety plug would burst and allow the refrigerant to escape.

3. Do not carry the drum in the passenger compartment of a car. Always place drum in the luggage compartment of car. If a drum is carried in an open truck, shield it for protection from the sun's rays. This heat could increase the pressure enough to cause safety plug to burst.

4. Do not subject drum to high temperature when charging system -- use water no warmer than 125°F to heat drum. Never place drum on steam radiator or stove, or use torches for heating during charging.

5. Do not discharge refrigerant 12 into areas where there is an exposed flame or where it could be drawn into the engine air intake when the engine is operating. Concentrations of this gas in contact with a flame may produce a poisonous gas.

6. Always wear goggles when doing work that involves opening the refrigerant lines. An accident can easily cause liquid refrigerant to strike the face. If goggles protect the eyes, the likelihood of serious injury will be reduced. A skin injury can be bathed with cold water and treated in the same manner as frostbite. If refrigerant liquid should strike the eye, proceed as follows:

a. Do not rub it in. Splash the affected area with quantities of cold water to bring the temperature gradually above the freezing point. Apply a few drops of antiseptic oil to provide a protective film.

b. If irritation continues, wash the eyes with a weak solution of boric acid.

c. Consult an eye specialist immediately for treatment.

b. Handling Lines

1. Store all lines to avoid crushing or kinking.

2. Lines should be kept sealed and dehydrated in stock. Do not remove shipping caps from lines until just before installation.

3. Always use two wrenches when tightening fittings to prevent twisting the hoses or soft aluminum tubing. Lubricate all fittings with refrigeration oil to allow the joint to be tightened without twisting the pipe.

4. Cap ends of lines that have been disconnected for any reason, to prevent entrance of moisture or dirt.

5. Gage set and lines should be kept clean and free from moisture.

6. Do not leave refrigeration oil container open any longer than necessary, as the special oil is moisture-free, but will rapidly absorb moisture from the air.

7. Use Vacuum Pump, J-5428, or Charging Station, J-8393, to remove any air or moisture that may have entered the system when it was opened to replace a part.

c. Collision Service

It is very important that the air conditioning system be inspected as soon as possible whenever a car so equipped has been involved in a collision. If the system has been opened as the result of a collision, it will permit the entry of air, moisture, and dirt that will cause internal damage. As the length of time the system has been open and the extent of damage to the components will govern the replacement of parts and the service operations required, a definite procedure cannot be recommended to cover all cases. The following, however, may be used as a guide:

1. Make certain clutch is disengaged, if car is to be operated before repairs are made.

2. Inspect all units and lines, noting any damage.

a. If condenser is damaged, it should be replaced. No repairs such as soldering, brazing or welding should be attempted.

b. Replace dehydrator-receiver assembly if damaged, leaking, clogged or restricted, or if system was open for any period of time.

3. Check compressor and clutch pulley for cracks. If compressor does not show evidence of external damage, it may be used.

d. Welding

Excessive heat applied to any section of the refrigerant lines will create excessively high pressures. For this reason, welding should not be performed on any portion of the car adjacent to the refrigerant units or lines.

e. Undercoating

To simplify service operations, undercoating should not be applied to any connections or rubber lines of the refrigeration system. While it is permissible to undercoat the metal refrigerant lines, all flare joints and connections should first be masked.

f. Replacing Components

When removing any components or lines from the system, they must be capped and plugged immediately to prevent exposing them to moisture.

All components of the air conditioning system are shipped dehydrated and sealed. They are to remain sealed until just prior to making connections and should be at room temperature before uncapping to prevent condensation of moisture from the air that enters the component. They should not be uncapped any longer than necessary to make a connection.

All precautions should be taken to prevent damage to the fitting and connections. Any fittings with grease or dirt on them should be cleaned prior to assembly, using a clean cloth dipped in alcohol. If dirt, grease or moisture gets inside lines and cannot be removed, lines may have to be replaced.

All blue O-rings for making closures for shipment should be discarded and new black O-rings used for making final refrigerant connections.

Use a small amount of refrigeration oil on all tubes and hose joints and lubricate the O-rings with this oil before assembly. Always slip the lubricated O-ring onto the flange tube to insure proper locating and sealing.

All O-ring connections should be tightened with torque wrenches and a crowfoot wrench (used at a 90° angle to the torque wrench for accurate reading,) in accordance with the following table. Note that the torque specified for aluminum or copper tubing is less than that specified for steel tubing.

If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification. Use steel torques only when both ends of connection are steel.

Backing wrenches of the required size must be used during the final tightening of all O-ring and flare-type connections.

10. Maintenance and Inspection

a. Preliminary Check

1. Check air gap between frictional surfaces of pulley and clutch plate. Air gap should be approximately 1/32 inch (.031 inch - .057 inch).

2. Check drive belt tension and adjust if necessary. See Note 13c.

3. Observe clutch to make certain that it is engaging and disengaging.

4. If there is evidence of oil leaks, leak test entire system and make necessary repairs. See Note 12.

5. Check sight glass for full charge of refrigerant. If system is low, leak test and make necessary repairs. See Note 20.

NOTE: It is normal for some foaming to occur in the sight glass with an outside air temperature of 70°F or below.

6. Add refrigerant as necessary, see Note 22, and repeat leak test of system.

7. Check operation of blower in all positions.

8. Check for air leaks through dash panel and through heater doors.

9. Turn system on and check operation. If cooling efficiency is doubtful, conduct performance test. See Note 14.

b. Seasonal Operation

1. Check drive belt tension and adjust if necessary. See Note 13c.

2. Observe clutch to make certain it is engaging and disengaging.

3. Check sight glass for full charge of refrigerant. If system is low, leak test and make necessary repairs. See Note 12.

4. Add refrigerant as necessary, see Note 22 and repeat leak test of system.

5. Check operation of blower in all positions.

6. Turn system on and check operation. If cooling efficiency is doubtful, conduct performance test. See Note 14.

11. Maintaining Chemical Stability

The efficient operation of the air conditioning system is dependent on the pressure-temperature relationship of pure refrigerant 12. As long as the system contains pure refrigerant 12 (plus a certain amount of refrigeration oil which mixes

Metal Tube O.D. (In Ins.)	Thread and Fitting Size (In Ins.)	Steel Tubing Torque (Ft. Lbs.)	Alum. or Copper Tubing Torque (Ft. Lbs.)	Nominal Torque Wrench Span (In Ins.)
1/4"	7/16"	15	7	5/8"
3/8"	5/8"	35	13	3/4"
1/2"	3/4"	35	13	7/8"
5/8"	7/8"	35	21	1-1/16"
3/4"	1-1/16"	35	28	1-1/4"

with the refrigerant), it is considered to be chemically stable.

When foreign materials, such as dirt, air or moisture are allowed to get into the system, they will change the pressure-temperature relationship of the refrigerant. The system will no longer operate at the proper pressures and temperatures, and the efficiency of the system will decrease.

The following general practices should be observed to insure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant connection, wipe away any dirt or oil at or near the connection to eliminate the possibility of dirt entering the system. Both sides of the connection should be immediately capped or plugged to prevent the entrance of dirt, moisture, or foreign material. All air contains moisture. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly.

2. Tools should be kept clean and dry. This includes the Charging Station and the Gage Set.

3. When adding oil, the container and the transfer tube through which the oil will flow should be exceptionally clean and dry in order to keep the refrigeration oil as moisture-free as possible. For this reason, the oil container should not be opened until ready for use, and should be capped immediately after use.

4. When it is necessary to open a system, have everything needed ready and handy so that as little time as possible will be required to perform the operation. Do not leave the system open any longer than is necessary.

5. Any time the system has been opened and sealed again, it must be properly evacuated, as described in Note 19.

6. Use only refrigerant from a reputable dealer, as contaminated refrigerant will not only lower the efficiency of the system, but will damage the unit. Use only refrigerant 12 as refrigerant for the Cadillac system, since any other refrigerant will damage the compressor or other parts by incorrect pressure-temperature relationship.

12. Leak Detectors

There are two methods that may be used for detecting leaks in the air conditioning system. The use of a leak detector fluid or a torch type leak detector is recommended.

a. Leak Detector Fluid

Leak detector fluid (mixed with water per directions on bottle) may be used by daubing or squirting the liquid around joints to be tested. Ordinary leaks will form a cluster of bubbles almost immediately. Extremely small leaks will form a white foam which will materialize with a time limit from a few seconds to a minute, depending on size of leak.

In order to locate leaks with this fluid, it is essential that you see all of the surfaces you are checking with a good light; otherwise small leaks could easily be overlooked.

b. Torch Type Leak Detector

Detecting a leak with the torch type detector is accomplished by observing the color of the flame in the head of the detector, when the sampling tube is close to a refrigerant leak.

The flame can be described as three different colors: green, blue, and purple. Green indicates a small leak, blue indicates a medium leak, and purple indicates a large leak.

CAUTION: Flames from detector are very toxic and can cause severe damage to lungs if inhaled. It is possible to create phosgene gas if refrigerant comes in contact with metal heated to 800°F. Hydrogen chloride gas is more commonly created using the torch type leak detector.

To operate unit, open valve until a low hiss of gas is heard, then light the flame at opening in detector chimney. Adjust flame until blue flame is approximately 3/8 inches above reaction plate to make detector as sensitive as possible for small leaks.

When checking for leaks, always position sampling tube below fitting or area to be tested, as refrigerant 12 is a heavy vapor and will sink when exposed to air.

It is best to test low pressure side of system at drum pressure, which is much higher than normal low side operating pressure.

In testing high pressure side for leaks, run system for a few minutes to build up pressure in high pressure side of system. Then stop engine and test high pressure side of system for leaks.

13. Adjustments

a. Temperature Door Link

If discharge air temperature at which system changes modes is either too warm or too cool,

turn adjusting screw clockwise to increase the temperature or counterclockwise to decrease the temperature. However, do not turn adjusting screw more than one-quarter of a turn at a time.

1. Remove horseshoe clip securing link to temperature door arm and disengage link from arm.

2. Apply at least 10 inches Hg. of vacuum to power servo vacuum power unit.

3. Push temperature door arm toward left side of car to stop.

4. Expand link by compressing tangs and place link on temperature door arm.

5. Insert a .002 inch feeler gage between adjusting screw and tang and adjust screw to .002 inch clearance with temperature door held against stop.

6. Install horseshoe clip securing link to temperature door.

b. Temperature Dial

NOTE: If system is working properly, perform temperature dial test as described in Notes 16a step 6, 16b step 7 or 16c.

1. Insert Temperature Dial Adjuster, J-21530, between temperature dial and casting, Fig. 1-21.

2. Turn dial to proper setting as determined by test procedures being used.

NOTE: When setting temperature dial the desired numeral should be lined up with slot in control panel.

c. Compressor Drive Belt (Except 693)

1. Place Belt Tension Gage, J-7316, on drive belt mid-way between pulleys.

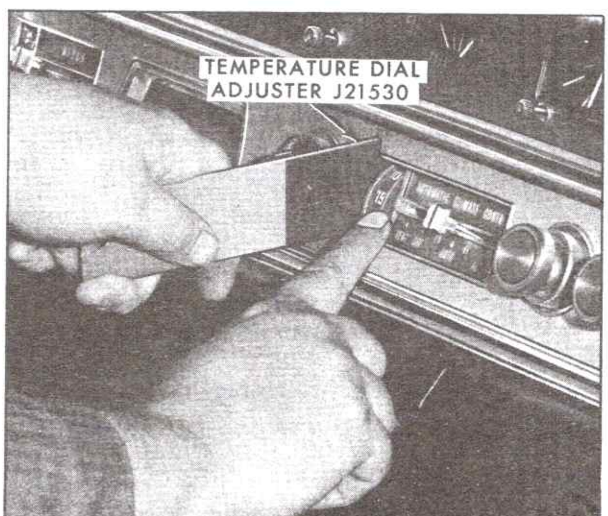


Fig. 1-21 Adjusting Front Temperature Dial

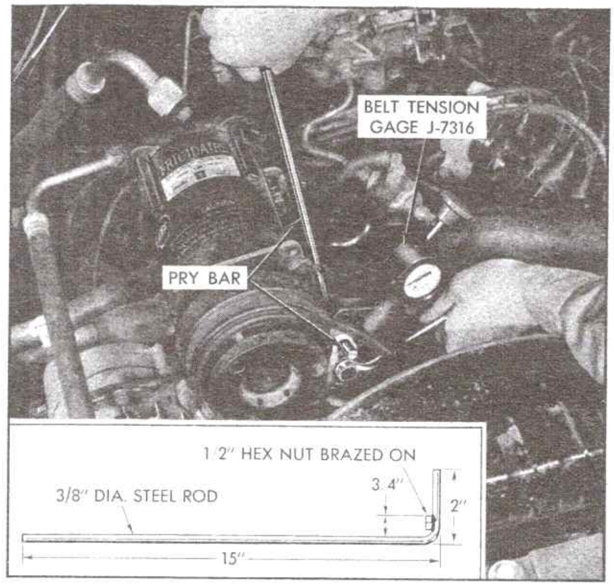


Fig. 1-22 Adjusting Compressor Belt Tension

2. Loosen two bolts securing compressor to mounting brackets at pivot points.

3. Insert pry bar, Fig. 1-22, in front pivot channel and push rearward and downward, adjusting belt tension to 70 pounds for a used belt and 100 pounds for a new belt.

4. While still applying force, tighten front mounting bolt and then rear mounting bolt.

14. Performance Test

NOTE: The following procedures pertain to all models except Fleetwood Seventy-Five. Performance Tests for the Fleetwood Seventy-Five Air Conditioning Systems are explained in Note 59.

To determine the efficiency of the air conditioning system, run a performance test as outlined below:

1. Place transmission in PARK and start engine.

2. Check operation of controls by placing Automatic Climate Control lever in all positions and rotating temperature dial from stop to stop.

3. Turn off engine.

4. Purge high and low pressure lines on Charging Station J-8393.

5. Connect Charging Station high pressure line to high pressure fitting on compressor, and low pressure line to evaporator gage fitting on suction throttling valve.

6. Disconnect vacuum hose from power servo vacuum power unit and plug hose.

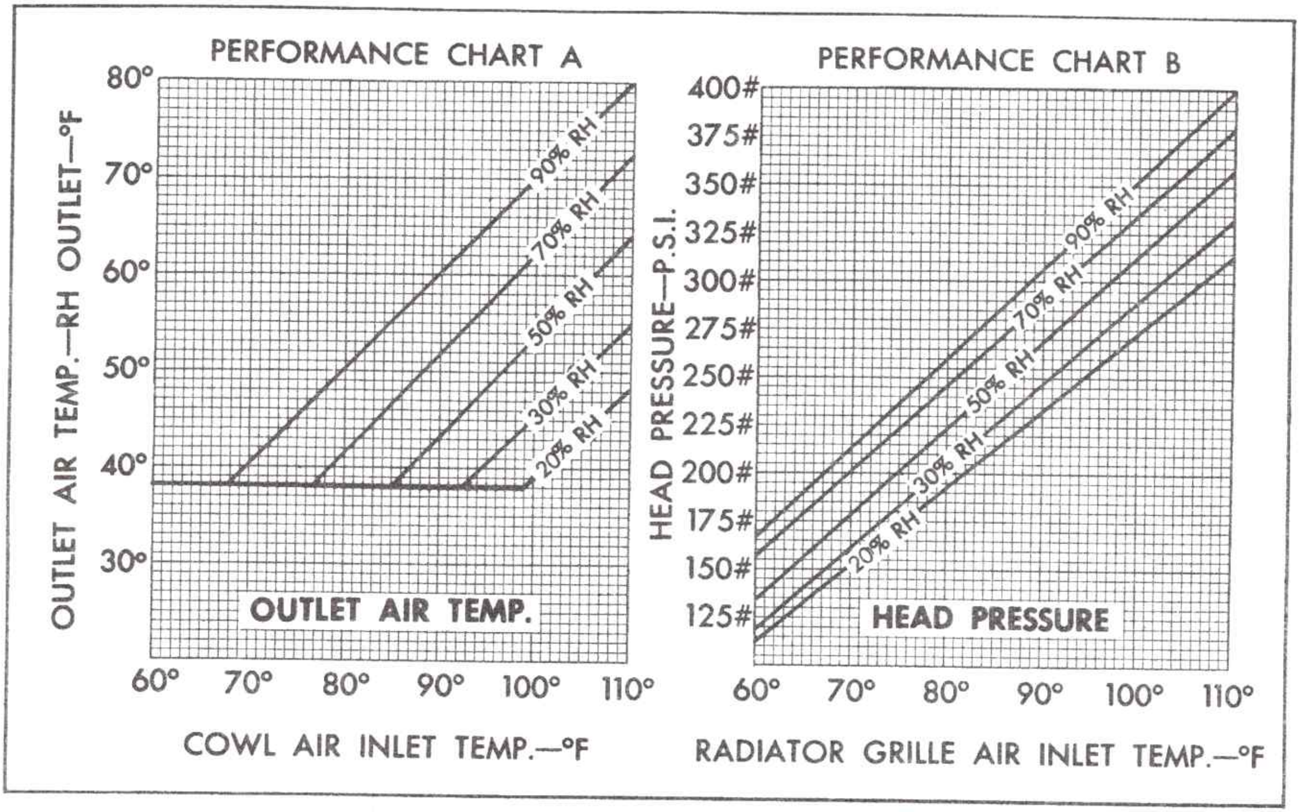


Fig. 1-23 A/C Performance Chart (Except 697)

7. Close hood as far as possible without pinching lines. Use masking tape to cover gap at rear of hood.

8. Place auxiliary fan (approximately 24 inch dia. blades) thirty inches from front bumper and direct air stream to center of radiator grille.

NOTE: Volume must be sufficient to obtain proper head pressure.

9. Place thermometer in air stream between auxiliary fan and radiator grille. Thermometer bulb must not contact any metal.

10. Place another thermometer in right air conditioning outlet grille. Thermometer bulb must not contact any metal.

11. Place Automatic Climate Control lever in HI position.

12. Open all doors and windows.

13. Use Humidicator, J-6076, to obtain simultaneous temperature and relative humidity reading of air entering cowl air intake grille as follows:

a. Shake thermometer down to settle red and blue columns in bottom of tubes.

b. Thoroughly moisten wick on blue thermometer with water.

c. Place humidicator on right hand side of cowl air intake grille so that entering air passes over bulbs of thermometer.

14. Turn on auxiliary fan.

15. With transmission in PARK, start engine and operate at 2,000 rpm.

16. After five minutes record:

a. Humidicator red and blue bulb readings. (Red bulb reading is temperature of air entering cowl air intake grille.)

b. Temperature of air being discharged through right air conditioning outlet.

c. Temperature of air entering radiator grille.

d. Head pressure.

e. Evaporator pressure.

17. Turn off engine and auxiliary fan.

18. To determine relative humidity of air entering cowl air intake grille, position inner scale of humidicator so that blue (wet bulb) temperature is opposite red (dry bulb) temperature. Relative humidity is indicated by humidity arrow. Record relative humidity.

19. Refer to Chart A, Fig. 1-23, to determine if outlet air temperature is normal. If outlet

temperature is the same or below reading on chart, operation is normal.

20. Refer to Chart B, Fig. 1-23, to determine if head pressure is normal. If head pressure is within 30 pounds below reading on chart, operation is normal.

21. Disconnect Charging Station.

22. Install vacuum hose on power servo vacuum power unit, after unplugging.

15. Connecting Automatic Climate Control Tester

The Automatic Climate Control Tester, J-21512, and the Automatic Temperature Control Tester, J-22368-01, are used to isolate an electrical malfunction in the Automatic Climate Control System by serving as a substitute for components of the system. To connect either tester:

1. Remove steering column lower cover, as described in Section 12, Note 39.

2. Disconnect three-way connector from the amplifier on the control panel.

3. Connect three-way electrical connector of tester - the one with three female terminals - to amplifier terminals.

4. Connect second multiple connector of tester to car wiring harness.

5. Connect black ground clip to car body.

6. When using J-22368-01, disconnect large vacuum hose at transducer and insert tester tee in vacuum line.

16. Testing Automatic Climate Control System

Two testers are available to perform these tests. Due to differences between the testers, two procedures are given in this note. Follow the test procedure that applies to the tester to be used.

a. Using Automatic Climate Control Tester J-21512

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system, when the system turns ON, but operates only in maximum heat or maximum air conditioning at high blower speed. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 6. If system still performs incorrectly, proceed with listed tests. If the system has an intermittent condition, proceed to step 8.

For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.

1. Preliminary Test

a. Place Automatic Climate Control lever in AUTO position.

b. Place transmission in PARK and start engine.

c. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

d. Connect a vacuum hose from engine manifold fitting to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

e. If system and power servo performed properly in steps c and d, proceed to step 2.

f. If power servo performed properly, but system did not, in steps c and d, proceed to step 5.

g. If power servo and system failed to perform properly, proceed to step h.

h. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

2. Sensor String Test

a. Turn off engine if still operating, and connect Automatic Climate Control Tester, J-21512, as described in Note 15.

b. Place Automatic Climate Control lever in AUTO position and set temperature dial to 70° setting.

c. With transmission in PARK position, start engine.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512 in SENSOR position.

e. Place Sensor switch to A/C position. System and tester meter should go to full air conditioning.

f. Place Sensor switch in HTR position. System and tester meter should go to full heater.

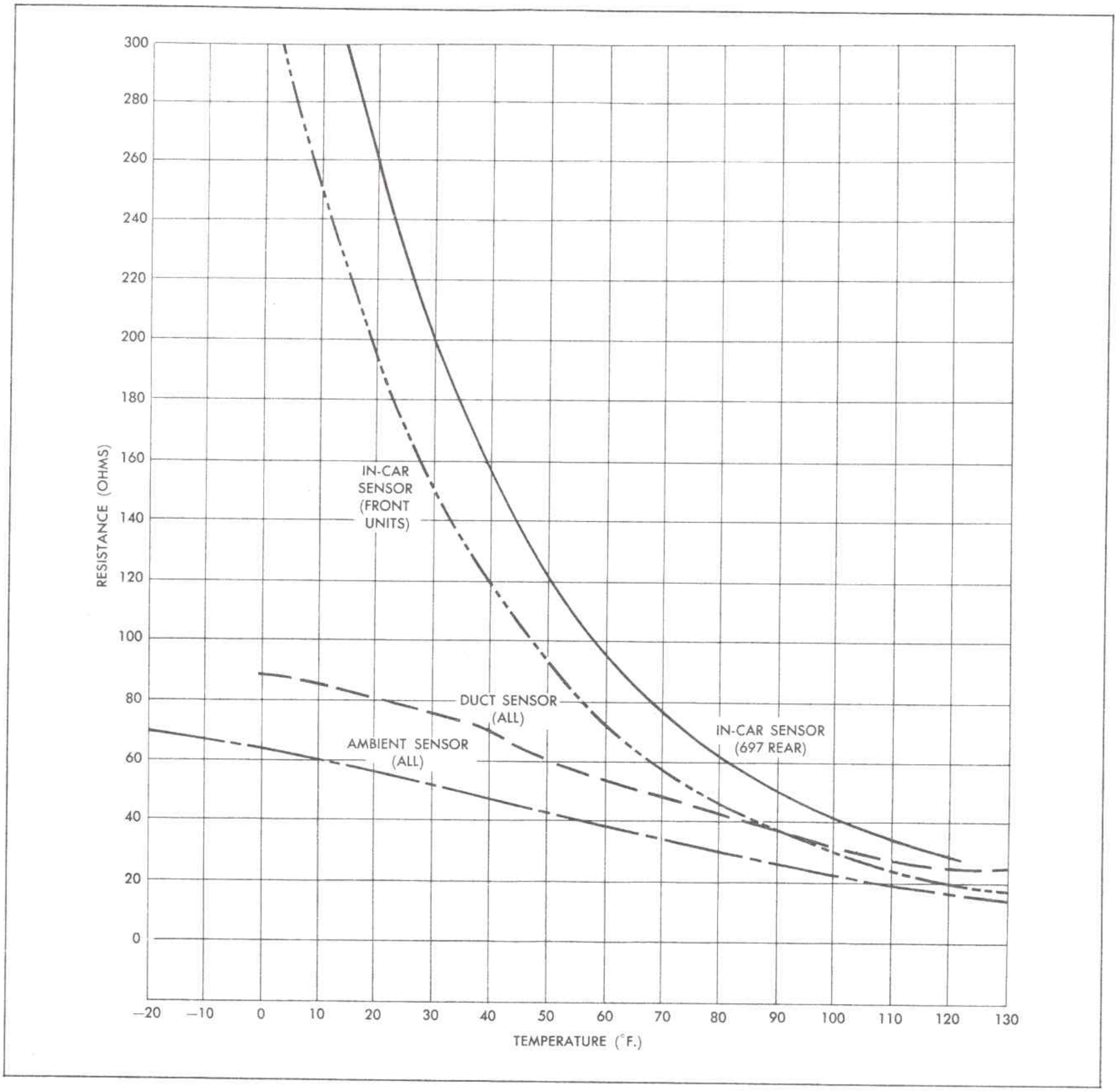


Fig. 1-24 Resistance Graph of Sensors

g. If system did not perform correctly in steps e and f, proceed to step 3.

h. If system performed correctly, disconnect Automatic Climate Control Tester and reconnect car wiring harness. Visually inspect in-car sensor, replace if apparently defective, and check operation of system.

i. Check for loose connector at duct sensor and then at ambient sensor. If loose connector was found, repair and check operation of system.

j. If an ohmmeter is available, measure resistance value of ambient sensor, duct sensor and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-24. Replace any defective sensor located. If no defective sensor is found, check car wiring.

k. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

3. Amplifier Test

CAUTION: Sensor string must be tested befor testing amplifier.

a. Place Amplifier switch on Automatic Climate Control Tester, J-21512 in AMPLIFIER position.

b. Turn Amplifier Control counterclockwise to stop. System and tester meter should go to full air conditioning. Tester meter will read at the A in AC on the meter when full AC is achieved.

c. Turn Amplifier Control clockwise to stop. System and tester meter should go to full heater. Tester meter will read off scale to the heat end.

NOTE: If tester meter does not vary with variation in Amplifier Control, transducer, or electrical circuit to transducer, is defective.

d. If steps b and c do not result in correct system operation, proceed to step 4.

e. If system operated properly in steps b and c, disconnect Automatic Climate Control Tester and reconnect car wiring harness to amplifier.

f. Disconnect green wire from temperature dial rheostat terminal. With wire open, system should go to full air conditioning.

g. Ground green wire. System should go to full heat.

h. If system performed properly in steps f and g, replace temperature dial rheostat.

i. If system failed to perform properly in steps f and g, replace amplifier circuit board.

j. If system fails to work properly after replacing amplifier circuit board, check car wiring.

4. Regulated Vacuum Test

NOTE: Automatic Climate Control Tester, J-21512, should still be plugged in and engine should be running.

a. Connect a vacuum gage to transducer vacuum input hose. Gage should read above 14 inches Hg. If not, locate and correct vacuum failure.

b. Reconnect vacuum input hose and connect vacuum gage to transducer output fitting, using a length of vacuum hose.

c. Make certain that Automatic Climate Control lever is in AUTO position and temperature dial is at 70° setting.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512 in SENSOR position. Turn Sensor switch to MID position and rotate temperature dial until tester meter needle reads on set line. Vacuum gage should read between 3.5 inches Hg. and 7.2 inches Hg. If not, replace transducer.

e. Rotate temperature dial to 65° setting, vacuum gage should be 1.5 inches Hg. or less. If vacuum reading is higher, turn Sensor switch to A/C position, gage should now read 1.5 inches Hg. or less. If not, replace transducer.

f. Repeat step d.

g. Rotate temperature dial to 85° setting, vacuum gage should read 10 inches Hg. or more. If vacuum reading is lower, turn Sensor switch to HTR position, gage should now read 10 inches Hg. or more. If not, replace transducer.

h. Rotate temperature dial to 70° setting and place Amplifier switch in AMPLIFIER position. Rotate tester Amplifier control from stop to stop. Output of transducer should vary between 1.5 inches Hg. or less, to 10 inches Hg. or more within 10 seconds. If not, replace transducer.

i. If transducer output varied as specified, tee vacuum gage between power servo vacuum power unit and vacuum hose from transducer output.

j. Rotate tester Amplifier control from stop to stop. If vacuum readings are different than readings obtained in step h, check hoses for leaks, kinks or breaks.

5. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the driver's seat.

b. Set the temperature dial to 70°, move the control lever to AUTO position and start engine. Vacuum gage should read above 14 inches Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inches Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inches Hg. or less and remain there.

NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.

d. Rotate temperature dial back to 70° setting.

e. Move control lever through all positions, VENT, OFF, LO, AUTO, HI, FOG, and ICE, allowing system time to stabilize in each position. Vacuum reading should always be above 14 inches HG. except in OFF position, where there should be no vacuum reading.

f. If a vacuum leak is present, determine when it is present. Then, referring to Figs. 1-12 and 1-13, determine what valves, hoses and vacuum power units are involved to locate leak.

6. Temperature Dial Test with Automatic Climate Control Tester, J-21512.

NOTE: This test can be made only when the system is operating properly.

a. Place Amplifier switch in SENSOR position.

b. Place Sensor switch in MID position.

c. Adjust temperature dial until tester meter reads on set line. Temperature dial should read 70°.

d. If temperature dial does not read 70°, adjust dial as described in Note 13b.

7. Shut off engine and remove Automatic Climate Control Tester from system and connect car wiring harness to amplifier connector.

8. Intermittent Conditions

a. Connect the positive lead of an accurate voltmeter to the transducer wire at the transducer connector. Ground the negative lead to the car body.

b. Allow system to operate in AUTO position and stabilize.

c. Tap the sensors, temperature dial and amplifier. A severe rap on the dash panel, cover, kick pad or distributor ducts is necessary. Jiggle wires on the various units.

d. Watch the voltmeter for any sharp variation in the meter reading. Note the operation of the system.

e. If a variation occurs when a unit is tapped, check that unit for weak connections. Repair connections as necessary.

b. Using Automatic Temperature Control Tester J-22368-01

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 7. If system still performs incorrectly, proceed with listed tests.

For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.

1. Preliminary Test

a. Place Automatic Climate Control lever in AUTO position.

b. Place transmission in PARK and start engine.

c. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

d. Connect a vacuum hose from engine manifold fitting to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

e. If system and power servo performed properly in steps c and d, proceed to step 3.

f. If power servo performed properly, but system did not, in steps c and d, proceed to step 6.

g. If power servo and system failed to perform properly, proceed to step h.

h. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

i. If system failed to come on, proceed to step 2.

2. Source Test

a. Turn off engine if still operating and connect Automatic Temperature Control Tester, J-22368-01, as described in Note 15.

b. Place Automatic Climate Control lever in AUTO position. Set temperature dial to 75° setting.

c. With transmission in PARK position, start engine.

d. Place rocker switch on Automatic Temperature Control Tester, J-22368-01, in MANUAL position.

e. Turn voltage knob to SOURCE position.

f. Set manual control knob to 150 position.

g. Tester meter should read battery voltage.

h. If meter does not read battery voltage, check the power supply wires for shorts, ground or opens. Check for blown fuse. The tester may be used for checking the wiring by turning the voltage knob to the PROBE position and using the red probe.

i. If meter read battery voltage in step g, proceed to step 3.

3. Sensor String Test (Opens)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to SENSOR position.

c. Set manual control knob to 150 position.

d. Tester meter should read battery voltage.

e. If meter read battery voltage in step d, proceed to step 4.

f. If meter did not read battery voltage in step d, visually inspect in-car sensor, replace if apparently defective, and check operation of system.

g. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

h. If an ohmmeter is available, measure resistance value of ambient sensor, duct sensor and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-24. Replace any defective sensor located. If no defective sensor is found, check car wiring.

i. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

4. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to AMPLIFIER OR CONTROL CALIBRATION position.

c. Turn manual control to MAX-HEAT position.

d. Meter should read from 0 to 4 volts.

e. Turn manual control to MAX-COLD position.

f. Meter should read 8 volts minimum.

g. If steps c through f do not result in correct readings, proceed to step i.

h. If proper readings were obtained in steps c through f, proceed to step 5.

i. Disconnect green wire from temperature dial rheostat terminal. With wire open, system should go to full air conditioning, meter should read 8 volts minimum.

j. Ground green wire. System should go to full heat, meter should read 0 - 4 volts.

k. If system performed properly in steps i and j, replace temperature dial rheostat.

l. If system failed to perform properly in steps i and j, replace amplifier circuit board.

m. If proper readings are not achieved after replacing amplifier circuit board, check car wiring.

5. Transducer Test

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to TRANSDUCER position.

c. Turn manual control to MAX-COLD position.

d. Tester meter should read 8 volts minimum and vacuum gage should read 0-3 inches vacuum. Maximum blower should be achieved.

e. Turn manual control to MAX-HEAT position.

f. Tester meter should read 0-4 volts and vacuum gage should read 9 inches minimum vacuum. Maximum blower should be achieved.

g. If proper readings are not obtained in steps c through f, check wire to transducer circuit for shorts, opens, or grounds. Check for improperly grounded transducer. Replace transducer.

h. If transducer output varied as specified, tee vacuum gage between power servo vacuum power unit and vacuum hose from transducer output.

i. Repeat steps c through f. If vacuum readings are different than readings obtained in steps c through f, check hose for leaks, kinks or breaks.

6. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the driver's seat.

b. Set the temperature dial to 75°, move the control lever to AUTO position and start engine. Vacuum gage should read above 14 inches Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inches Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inches Hg. or less and remain there.

NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.

d. Rotate temperature dial back to 75° setting.

e. Move control lever through all positions, VENT, OFF, LO, AUTO, HI, FOG and ICE, allowing system time to stabilize in each position. Vacuum reading should always be above 14 inches Hg. except in OFF position, where there should be no vacuum reading.

f. If a vacuum leak is present, determine when it is present. Then, referring to Figs. 1-12 and 1-13, determine what valves, hoses and vacuum power units are involved to locate leak.

7. Temperature Dial Test with Automatic Temperature Control Tester, J-22368-01.

a. Place rocker switch in MANUAL position.

b. Set voltage knob to AMPLIFIER OR CONTROL CALIBRATION setting.

c. Set manual control to 135 position.

d. Rotate temperature dial until tester meter indicates 6.5 volts.

e. Temperature dial should indicate 75°F.

f. If temperature dial does not indicate proper setting, adjust temperature dial as indicated in Note 13b.

8. Operational Test (All except 697)

For procedures to perform operational test on Fleetwood Seventy-Five, refer to Note 61b, step 8.

a. Position rocker switch in the AUTOMATIC position.

b. Set voltage knob to AMPLIFIER OR CONTROL CALIBRATION position.

c. Set manual control to 150 position.

d. Allow 5 minutes for system to stabilize with doors and windows closed.

e. Meter should read 5.5 - 7.5 volts.

f. If improper reading is obtained in step e, check for shorted sensors.

g. If proper reading is achieved in step e, tap sensors and amplifier.

h. If meter needle jumps when a unit is tapped, check that unit for weak connections that will cause an intermittent defect in the system.

i. If proper reading is achieved in step e, with no movement of the needle in step h, and all steps in procedures 1-7 have been completed, system is operating properly.

j. Shut off engine and remove Automatic Temperature Control Tester, J-22368-01, from system. Connect car wiring harness to amplifier connector and large vacuum hose to transducer. Install any trim items removed.

c. Temperature Dial Operational Test

NOTE: This test is performed without the Automatic Climate Control Tester, J-21512 or the Automatic Temperature Control Tester J-22368-01. Although it is less efficient, it allows for the tailoring of a system to meet the requirements of an individual owner. For procedures to perform temperature dial operational tests on Fleetwood Seventy-Five, refer to Note 61c.

a. Using masking tape, suspend an accurate thermometer from headliner so that bulb hangs at breath level over front passenger's seat.

b. Position auxiliary fan (approximately 24 inch dia. blades) so that air stream is directed across cowl air intake grille.

c. Close all doors and windows.

d. Place Automatic Climate Control lever in AUTO position and set temperature dial to 75°.

e. With shift lever in PARK position, start engine and operate at 900 rpm.

f. Making certain that all air conditioning outlets are open, adjust end outlets so that air is directed toward doors. Adjust center outlet so that air stream is directed toward top of front seat.

CAUTION: Outlet air must not be directed toward thermometer.

g. Allow system to operate for 25 minutes for stabilization, then record reading from suspended thermometer.

h. If thermometer reading varies from 75° setting, adjust temperature dial to coincide with readings as described in Note 13b.

17. Purging Refrigerant From System

When replacing any air conditioner component, the system must be purged (drained) of refrigerant. The purpose is to lower pressure inside the system so that a component part can be safely removed. Following is a simplified procedure for purging refrigerant from system.

CAUTION: Always wear goggles when doing work that involves opening refrigerant lines.

1. Remove caps from high pressure fitting on compressor and gage fitting on suction throttling valve.

2. Install Gage Adapters, J-5420, on high and low pressure fittings.

3. Tighten adapters to depress valve cores until a hissing sound is heard, indicating that refrigerant is escaping from system at each adapter.

NOTE: Do not overtighten adapters; otherwise, oil will escape from system. Refrigerant should escape in a vaporous form. If any trace of oil is detected, loosen adapters.

18. Connecting Charging Station, J-8393

1. Remove caps from high pressure fitting on compressor and the gage fitting on suction throttling valve.

2. Make certain that all valves on Charging Station are closed.

3. Install Gage Adapters, J-5420, on Charging Station high and low pressure lines.

4. Connect Charging Station high pressure line to fitting on compressor, and low pressure line to gage fitting on suction throttling valve, Fig. 1-25.

19. Evacuating System

Whenever the air conditioning system is opened for any reason, it should not be put into operation again until it has been evacuated several times. For this operation use Charging Station, J-8393, to remove air and moisture that may have entered the system.

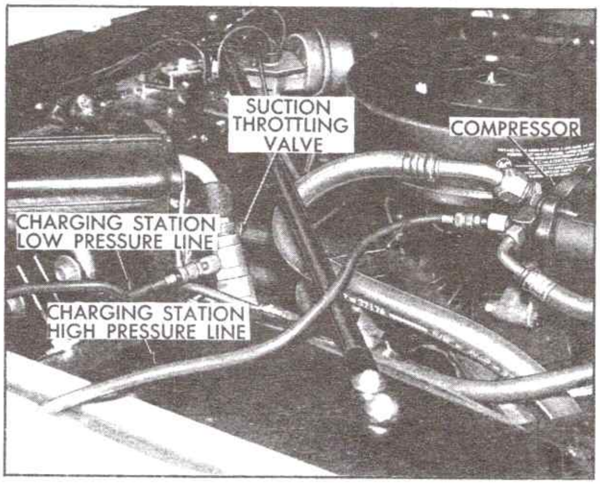


Fig. 1-25 Connecting Charging Station Lines

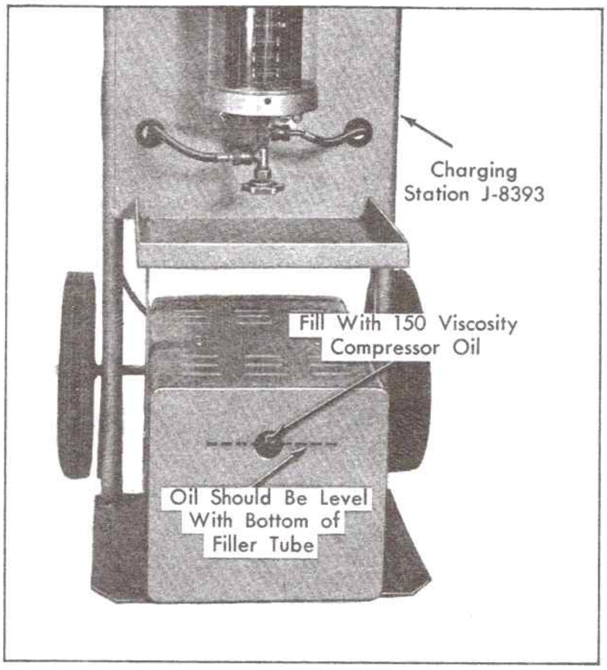


Fig. 1-26 Vacuum Pump Oil Level

Check Charging Station vacuum pump oil level at oil filler screw on front of pump. Oil should be level with bottom of filler tube, Fig. 1-26. Add 150 viscosity refrigeration oil to bring to proper level. Change the oil in pump every 250 hours of operation. A small amount of 150 viscosity oil may be drawn into the pump occasionally to insure protection of internal parts during periods of disuse. If the pump should fail to start, check capacitor or relay.

1. Purge system as described in Note 17.

2. Connect Charging Station high and low pressure lines as described in Note 18.

3. Plug in Charging Station to 110 volt outlet and turn on vacuum pump switch.

4. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 3 (vacuum control).

5. Operate to obtain 28 inches of vacuum, then continue to operate pump for ten minutes.

6. While evacuating the system, add refrigerant to cylinder on Charging Station by opening valves on refrigerant drum and at bottom of cylinder (valve 4 must be closed). Open valve on top of cylinder until proper liquid level is obtained in sight tube, and then close both top and bottom valves on cylinder.

7. Close valves 1, 2 and 3 and turn off vacuum pump switch. System should hold vacuum.

8. Slowly open valves 2 and 4, allowing 1/2 to 1 lb. of refrigerant to enter system, then close valves.

NOTE: It is advisable at this time to leak test system for major leaks as described in Note 12.

9. Purge system.

10. Repeat steps 4 and 5.

11. Repeat step 7.

12. System is now ready for complete charge of refrigerant as described in Note 21.

20. Checking Refrigerant Charge

Bubbles in the sight glass do not always indicate that the system is low on refrigerant. If the system is at a control point, bubbles may appear in the sight glass even though the system is fully charged.

A certain amount of foaming is also normal with an outside air temperature of 70°F or below.

Check refrigerant charge at the sight glass and proceed as described below to make certain that system is not at bubble producing control point.

1. Connect Charging Station low pressure line to gage fitting on suction throttling valve.

2. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

3. Run engine at 1500 rpm for 5 to 7 minutes to stabilize system.

4. Observe low pressure reading. Low pressure gage should read approximately 29 ± .5 pounds.

5. Slow down engine.

6. Maintain engine speed at this level, wait several minutes and then observe sight glass.

a. If a solid column of refrigerant appears in sight glass, it is an indication that charge in system is adequate or overcharged.

b. If bubbles appear in sight glass, it is an indication that system is low on refrigerant. Add refrigerant to system as described in Note 22.

21. Adding Refrigerant (Complete Charge)

1. Evacuate system as described in Note 19. The system must be properly evacuated.

2. Fill cylinder on Charging Station with refrigerant as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level is obtained in sight tube. (4 pounds on standard models, 5 1/4 pounds on Fleetwood Seventy-Five). Fleetwood Seventy-Five refrigerant will have to be added in two steps as required charge is greater than capacity of Charging Station cylinder.

3. Fully open valves 2 and 4 to allow refrigerant to flow into system.

NOTE: If refrigerant does not flow freely into system, it is probably due to valve cores in compressor and STV fittings not being depressed far enough. If this condition exists, try another Gage Adapter, J-5420, or build up an adapter depressor tongue with solder to depress valve core further.

4. After liquid refrigerant has stopped flowing into high pressure side of system, close valve 2.

5. Start engine and run at approximately 1500 rpm with shift lever in PARK position.

6. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

7. Open valve 1 (valve 4 must also be open). This will allow refrigerant remaining in cylinder to be pulled into system.

8. Shut off engine, close all valves, disconnect Charging Station high and low pressure lines and replace caps on fittings.

22. Adding Refrigerant (Partial Charge)

Refrigerant can be added to the air conditioning system using Charging Station, J-8393. The charging lines must be purged before any refrigerant is added.

1. Connect Charging Station as described in Note 18.

NOTE: Purge air from Charging Station high and low pressure lines before connecting. To purge lines, crack open valves 1, 2 and 4, making certain that there is some refrigerant in cylinder, then install lines and close valves.

2. Operate engine at 600 rpm with shift lever in PARK position.

3. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

4. Fill cylinder on Charging Station with 2 to 3 pounds of refrigerant, as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level is obtained in sight tube.

c. Close valve at bottom of cylinder.

5. Open valves 1 and 4. Watch sight glass until solid column of liquid appears, then close valves.

NOTE: It is normal for some foaming to occur in sight glass with an outside air temperature at 70°F or below.

6. After five minutes of operation, check sight glass again. If no bubbles appear, open valves 1 and 4 and add another 1/2 pound of refrigerant.

7. If bubbles appear, repeat steps 5 and 6.

8. Shut off engine, close all valves, disconnect Charging Station, and install gage fitting caps.

23. Adding Oil

The six-cylinder compressor uses 525 viscosity refrigeration oil. An oil charge of 10-1/2 fluid ounces is required, (13-1/2 fluid ounces on Fleetwood Seventy-Five models). It is important that only the specified type and quantity of oil be used in the compressor. If there is a surplus of oil in the system, too much oil will circulate with the refrigerant, causing the cooling capacity of the system to be reduced. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigeration system, certain procedures must be followed to assure that the total oil charge in the system is correct after the new part is on the car. When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. If a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge, it is necessary to compensate for this by adding oil to the new replacement part.

The procedures for adding oil are as follows:

a. Compressor Only

1. Idle engine for 10 minutes at 1000 - 1500 rpm at maximum cooling and high blower speed to allow oil to distribute itself in system in a normal manner.

2. Remove compressor from car and place it in a horizontal position with drain plug downward. Drain oil, measure, and discard it.

3. Drain oil from compressor that is to be installed in car.

4. If oil drained in step 2 is more than 4 fluid ounces, add to new compressor the same amount of oil as drained from replaced unit.

5. If the oil drained in step 2 is less than 4 fluid ounces, add 6 ounces of oil to new compressor.

b. Replacing Components

Whenever replacing a component of the air conditioning system, measured quantities of 525 viscosity refrigeration oil should be added to the component to assure that total oil charge in system is correct before unit is operated.

Oil should be added to replacement components as indicated below.

Evaporator (front or rear)	Add 3 fluid ozs.
Condenser	Add 1 fluid oz.
Receiver	Add 1 fluid oz.
Condenser and Receiver Assembly	Add 2 fluid ozs.

Oil should be poured directly into the replacement component. If an evaporator is installed, pour oil into inlet pipe with pipe held vertically so oil will drain into core.

If any other components, such as valves or hoses are replaced, no additional oil is necessary.

c. Compressor and Components

NOTE: If system has been operated and there is evidence of a major loss of oil, system has probably lost all or most of its refrigerant. If any refrigerant remains, discharge it from system. Do not operate compressor any more than is absolutely necessary to avoid damage from lack of oil.

1. Remove compressor and place in a horizontal position with drain plug downward. Drain oil from compressor, measure it and then discard it.

To promote draining, have suction connector open and tilt compressor as required.

2. Replace damaged component from which the oil was lost.

3. If more than 4 fluid ounces of oil was drained

from compressor in step 1, add same amount of new oil to compressor, plus an amount to compensate for that in damaged component, as shown in the table.

4. If less than 4 fluid ounces of oil was drained from compressor in step 1, add 6 fluid ounces of oil, plus amount shown in the table for component being replaced.

24. Automatic Climate Control Air Conditioner Control Panel

The procedure for removing and installing the control panel is described in Section 12, Note 59.

25. Air Conditioning Control Panel Disassembly and Assembly (Fig. 1-27)

The control panel must be removed as indicated in Section 12, Note 59 to perform any of the following procedures.

a. Amplifier Circuit Board Removal

1. Disconnect green wire from temperature dial rheostat terminal.

2. Disconnect red wire from Hi-Fog-Ice switch.

3. Remove two screws securing amplifier multiple connector to mounting plate.

4. Remove screw securing amplifier circuit board to mounting plate and remove circuit board.

b. Amplifier Circuit Board Installation

1. Position amplifier circuit board to mounting plate and install screw securing circuit board to mounting plate.

2. Install two screws securing amplifier multiple connector to mounting plate.

3. Connect red wire to Hi-Fog-Ice switch.

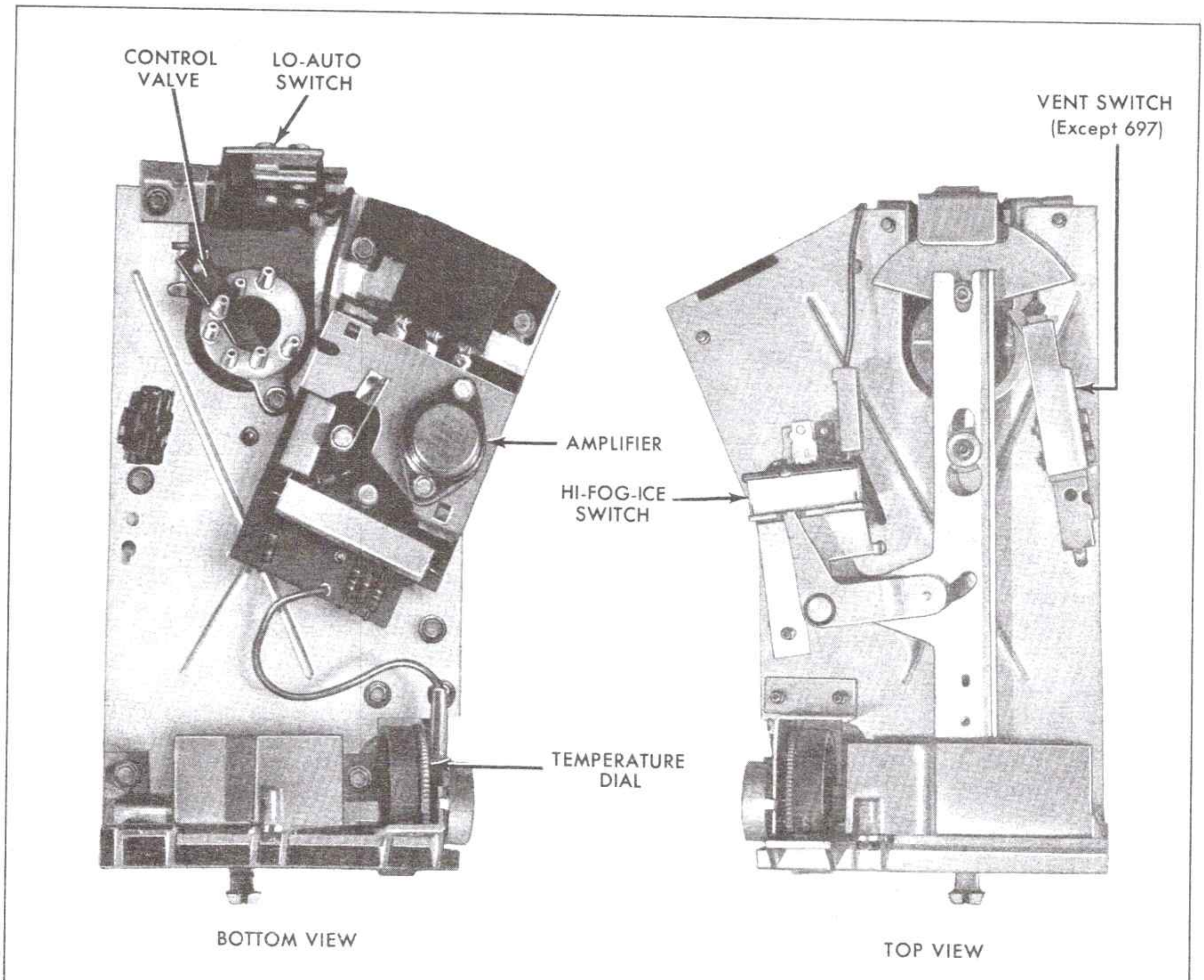


Fig. 1-27 Front Control Panel - Top & Bottom View

4. Connect green wire to temperature dial rheostat terminal.

c. Temperature Dial Rheostat Removal

1. Disconnect green lead from rheostat terminal.

2. Remove two screws securing rheostat bracket to mounting plate and remove rheostat.

d. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and install two screws securing rheostat to mounting plate.

2. Connect green lead to rheostat terminal.

3. After installing control panel on car, adjust temperature dial as indicated in Note 13b.

e. Control Vacuum Valve Removal

1. Remove Lo Auto switch as described in i.

2. Remove screw securing control vacuum valve to mounting plate.

3. Remove spring clip securing control vacuum valve to mounting plate and remove control vacuum valve.

f. Control Vacuum Valve Installation

1. Position control vacuum valve on mounting plate and secure with spring clip and screw.

2. Install Lo-Auto switch as described in j.

g. Hi-Fog-Ice Switch Removal

1. Disconnect red wire from Hi-Fog-Ice switch terminal.

2. Remove screw securing Hi-Fog-Ice switch to mounting plate and remove switch.

h. Hi-Fog-Ice Switch Installation

1. Position Hi-Fog-Ice switch on mounting plate with lug on switch in hole on mounting plate.

2. Secure Hi-Fog-Ice switch to mounting plate with one screw.

3. Connect red wire to Hi-Fog-Ice switch.

i. Lo-Auto Switch Removal

Remove two screws securing lo-auto switch to mounting plate and remove switch.

j. Lo-Auto Switch Installation

Position lo-auto switch on mounting plate and secure with two screws.

k. Vent Switch Removal (Except 697)

Remove screw securing vent switch to mounting plate and remove vent switch.

l. Vent Switch Installation (Except 697)

1. Position vent switch on mounting plate with lug on switch in hole on mounting plate.

2. Secure vent switch to mounting plate with one screw.

26. In-Car Sensor

The procedure for removing and installing the in-car sensor is described in Section 12, Note 60.

27. Ambient Switch and Sensor Assembly (Except 693)

a. Removal

1. Remove three screws securing right windshield garnish molding to windshield pillar and remove garnish molding.

2. Remove three screws securing right sill plate to sill and remove sill plate.

3. Remove right cowl kick pad by sliding rearward.

4. Disconnect electrical connector from terminals of ambient switch and sensor.

5. Remove two screws securing ambient switch and sensor assembly to air inlet assembly and remove switch and sensor assembly.

b. Installation

1. Position ambient switch and sensor assembly to air inlet assembly and secure with two screws.

2. Connect electrical connector to terminals of ambient switch and sensor.

3. Install right cowl kick pad by sliding forward between instrument panel and right side of cowl.

4. Position sill plate to sill and secure with three screws.

5. Position garnish molding to right windshield pillar and secure with three screws.

28. Duct Sensor (Except 693)

a. Removal

1. Disconnect electrical connector from sensor terminals.

2. Remove rubber hose connecting air conditioning distributor air vane to sensor in heater distributor.

3. Remove two screws securing sensor to heater distributor and remove sensor.

b. Installation

1. Position sensor to heater distributor and secure with two screws.

2. Install rubber hose connecting air conditioning distributor air vane to sensor.

3. Connect electrical connector to sensor terminals.

29. Water Control Valve

NOTE: The water control valve and thermal vacuum valve are serviced as an assembly.

a. Removal

1. Pinch off valve inlet and outlet water hoses.

2. Remove clamps securing hoses to valve, and remove water hoses.

3. Remove vacuum hoses from thermal vacuum valve, and remove vacuum hose from water control valve vacuum power unit.

4. Remove horseshoe spring retainer clip securing valve to mounting bracket and remove valve.

b. Installation

1. Position water control valve to mounting bracket and secure with horseshoe spring retainer clip.

2. Install water hoses on valve inlet and outlet fittings and install clamps on hoses.

3. Remove clamps pinching off hoses.

4. Install vacuum hoses on thermal vacuum valve.

NOTE: Yellow stripped hose connects to vacuum nipple closest to water outlet fitting.

5. Connect red stripped vacuum hose to water control valve vacuum power unit.

6. Replace any coolant lost.

30. Compressor Removal and Installation (Complete) (Except 693)

a. Removal

1. Remove carburetor air cleaner.

2. Purge system as described in Note 17.

3. Remove Allen screw securing suction and discharge connector to rear head, and remove connector, with lines attached, from the compressor.

4. Cover openings in both compressor and connector to keep dirt out. Use Test Plate, J-9527, over compressor openings.

5. Remove two screws securing compressor front mounting flange to adjusting bracket.

6. Disconnect electrical connector from clutch coil terminals.

7. Loosen rear pivot bolt and pivot compressor toward engine. Remove compressor drive belt.

8. Remove two nuts, bolts and washers retaining compressor rear adjusting bracket to support, and remove compressor.

b. Installation

NOTE: Before installing a replacement compressor, make certain the numeral 4 (5-1/4 on Fleetwood Seventy-Fives) is stamped 1/8 inch high on blank space provided in lower right hand corner of compressor name plate. If numeral is not evident, then stamp numeral as indicated. This numeral indicates the refrigerant capacity and must be shown on all compressors as required by law in some states.

1. Position compressor, with rear adjusting bracket attached, to mounts on engine, and install two bolts, nuts and washers securing rear adjusting bracket to support.

2. Install two screws securing compressor front mounting flange to adjusting bracket.

3. Install drive belt on compressor pulley and adjust drive belt as described in Note 13c.

4. Connect electrical connector to clutch coil terminals.

5. Using new O-rings, position suction and discharge connector to rear head and install Allen screw. Torque Allen screw to 15 foot-pounds.

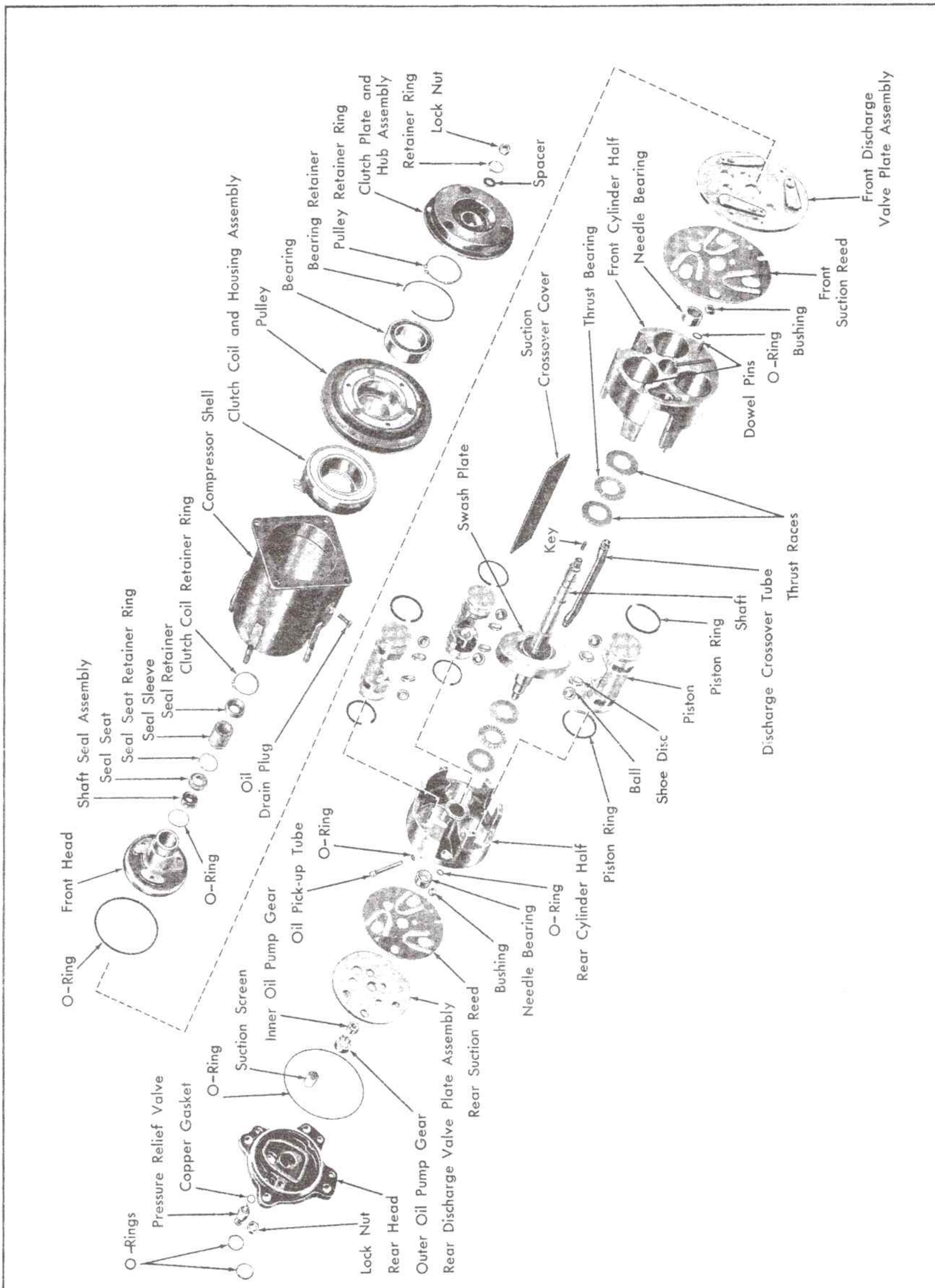


Fig. 1-28 Compressor Disassembled

6. Evacuate system as described in Note 19.

7. Install carburetor air cleaner.

8. Charge system as described in Note 21. Leak test all compressor connections.

CAUTION: All leaks must be repaired. Under no circumstances should a compressor be operated when a leak exists, as complete loss of refrigerant prevents oil return to the compressor.

31. Compressor Removal and Installation (Partial) (Except 693)

In order to perform certain engine operations it is necessary to move the compressor out of the way. This can be done without disconnecting any lines as follows:

a. Removal

1. Remove carburetor air cleaner.

2. Perform steps 5 through 8, Note 30a.

3. Move complete assembly clear of working area, being careful not to kink hoses. Wire compressor to a convenient location.

b. Installation

1. Perform steps 1 through 4, Note 30b.

2. Install carburetor air cleaner.

32. Compressor Service

When servicing the compressor, remove only the necessary components that preliminary diagnosis indicates are in need of service. Refer to Fig. 1-28 for information relative to parts nomenclature and location.

Some service operations can be performed without disturbing the internal mechanism assembly or completely removing the compressor from the car. Among them are replacement of the clutch plate and hub assembly, the pulley and bearing assembly, and pulley bearing.

The clutch coil and housing assembly also may be replaced without completely removing the compressor, after clutch and pulley parts have been removed. It is not necessary to disturb the shaft seal.

The shaft seal assembly can be replaced only by removing the compressor from the car and removing the clutch plate and hub assembly to gain access to the seal. A complete kit of shaft seal parts is available for field replacement.

Removal and installation of external compressor components and disassembly and assembly of internal components must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Parts Tray, J-9402, should be used for all parts being removed as well as for replacement parts.

Although certain service operations can be performed without completely removing the compressor from the car, the operations described herein are based on bench overhaul with the compressor removed from the car. They have been prepared in sequence in order of accessibility of the components.

When a compressor is removed from the car for servicing, the amount of oil remaining in the compressor should be drained and measured. This oil should then be discarded and new oil added to the compressor as described in Note 23.

33. Compressor Clutch Plate and Hub Assembly (Can be performed on car)

a. Removal

1. Place Holding Fixture, J-9396, in a vise, and secure compressor to fixture with pulley end up.

2. Keep clutch hub from turning with Clutch Hub Holding Tool, J-9403, and remove locknut from end of shaft, using Thin Wall Socket, J-9399, Fig. 1-29.

3. Thread Clutch Plate and Hub Assembly Remover, J-9401, into hub. Hold body of tool with a wrench and tighten center screw to remove clutch plate and hub assembly, Fig. 1-30.

4. Remove square drive key from shaft.

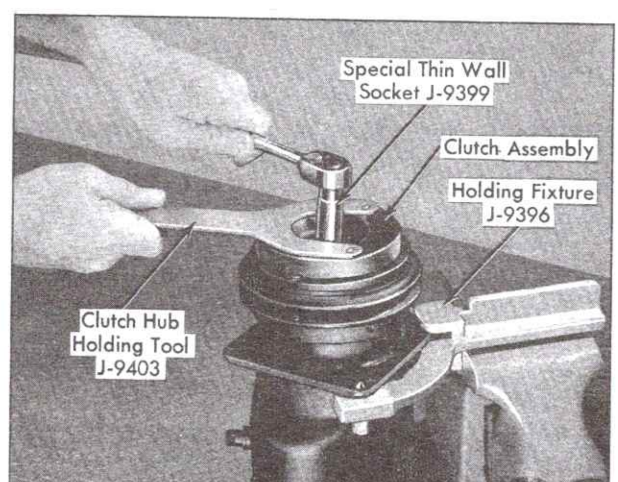


Fig. 1-29 Removing Lock Nut

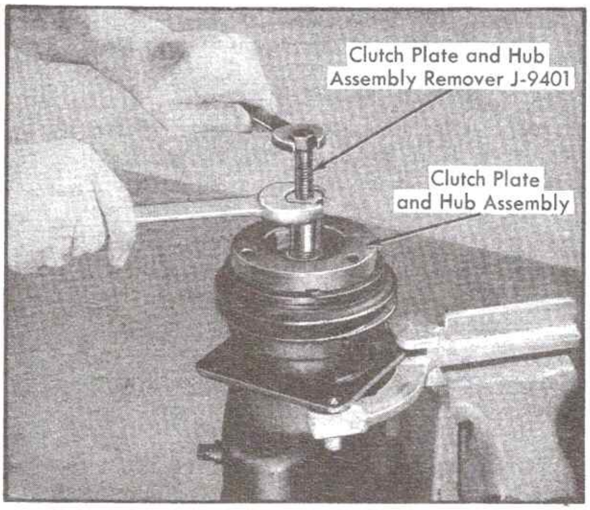


Fig. 1-30 Removing Clutch Plate & Hub Assembly

5. Remove hub retainer ring using Snap Ring Pliers, J-5403 (#21), and then remove hub spacer, Fig. 1-31.

b. Installation

1. Install square drive key on shaft, allowing it to project approximately 3/16 inch out of keyway.

2. Wipe frictional surface of clutch plate and pulley clean.

3. Place clutch plate and hub assembly on shaft, aligning shaft key with keyway in hub.

> CAUTION: To avoid internal damage to compressor, do not drive or pound on hub or shaft. This could mis-position swash plate on shaft, resulting in damage to compressor.

4. Place Spacer, J-9480-2, on hub, Fig. 1-28. Insert end of Clutch Plate and Hub Assembly Installer, J-9480, through spacer and thread tool onto end of shaft.

5. Hold hex portion of tool body with a wrench

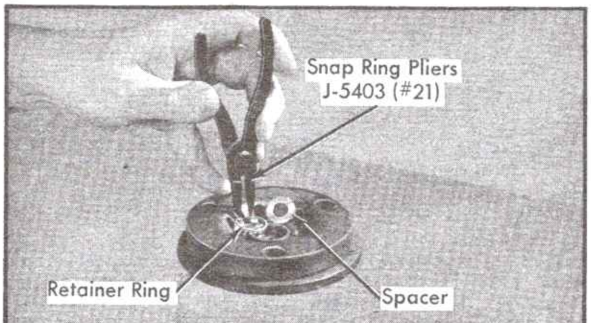


Fig. 1-31 Removing Hub Retainer Ring & Spacer

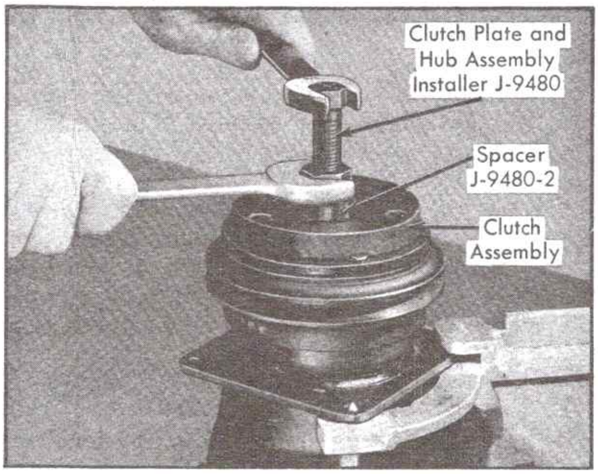


Fig. 1-32 Installing Clutch Plate & Hub Assembly

and tighten center screw several turns to press hub partially on shaft, Fig. 1-32.

6. Remove Clutch Plate and Hub Assembly Installer and Spacer. Check alignment of drive key with keyway in shaft. If alignment is correct, replace installer tools and continue to press hub onto shaft until there is approximately a 3/32 inch (.093 inch) air gap between frictional surfaces of pulley and clutch plate.

> NOTE: A zero thrust race is 3/32 inch thick and can be used as a gage between these frictional surfaces.

7. Remove Installer, J-9480, and Spacer, J-9480-2.

8. Install hub spacer.

9. Using Snap Ring Pliers, J-5403 (#21), install hub retainer ring with flat side of ring facing spacer.

10. Install a new shaft locknut with small diameter boss of nut against hub spacer, using special Thin Wall Socket, J-9399, Fig. 1-29. Hold clutch hub with Clutch Hub Holding Tool, J-9403, and tighten nut to 15 foot-pounds torque, using a 0-25 foot-pounds torque wrench. Air gap between frictional surfaces of pulley and clutch plate should now be approximately 1/32 inch (.031 inch to .057 inch), Fig. 1-33.

34. Compressor Pulley and Bearing Assembly (Can be performed on car)

a. Removal

1. Remove clutch plate and hub assembly as described in Note 33a.

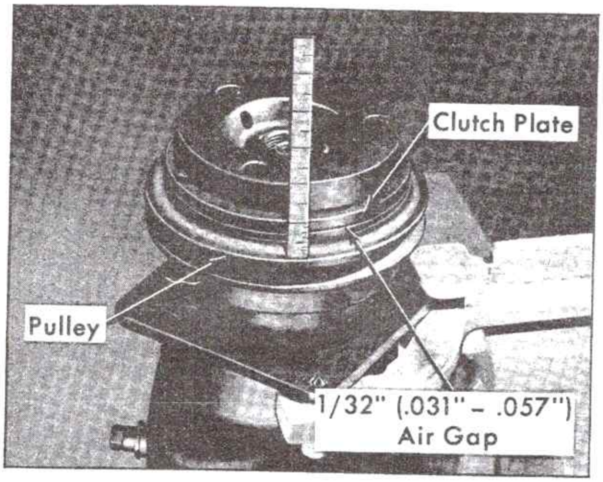


Fig. 1-33 Checking Air Gap

2. Remove pulley retainer ring using Snap Ring Pliers, J-6435 (#26), Fig. 1-34.

3. Place Puller Pilot, J-9395, over end of compressor shaft.

CAUTION: It is important that Puller Pilot, J-9395, be used to prevent internal damage to compressor when removing pulley. Under no circumstances should Puller be used directly against drilled end of shaft.

4. Remove pulley and bearing assembly using Pulley Puller, J-8433, Fig. 1-35.

b. Installation

1. If original pulley and bearing assembly is to be reinstalled, wipe frictional surface of pulley clean. If frictional surface of pulley shows any indication of damage due to overheating, pulley should be replaced.

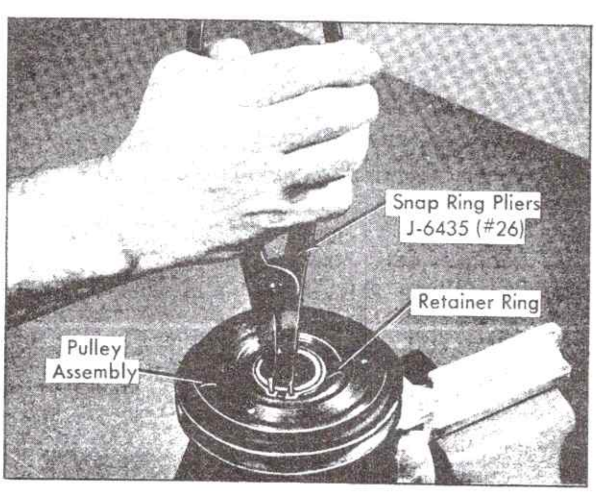


Fig. 1-34 Removing Pulley Retainer Ring

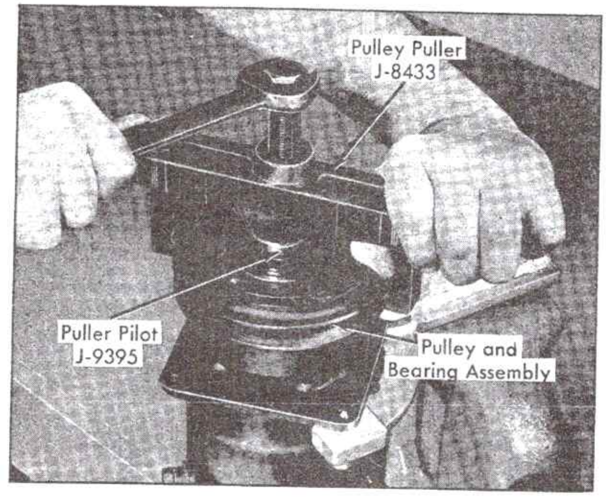


Fig. 1-35 Removing Pulley & Bearing Assembly

2. Check bearing for brinelling, excessive looseness, noise, and lubricant leakage. If any of these conditions exist, bearing should be replaced. The procedure for replacing bearing is described in Note 35.

3. Press or tap pulley and bearing assembly on neck of compressor until it seats, using Pulley and Bearing Installer, J-9481, with Universal Handle, J-8092, Fig. 1-36. Installer will apply force to inner race of bearing and prevent damage to bearing.

4. Check pulley for binding or roughness. Pulley should rotate freely.

5. Install retainer ring using Snap Ring Pliers, J-6435 (#26).

6. Install clutch plate and hub assembly as described in Note 33b.

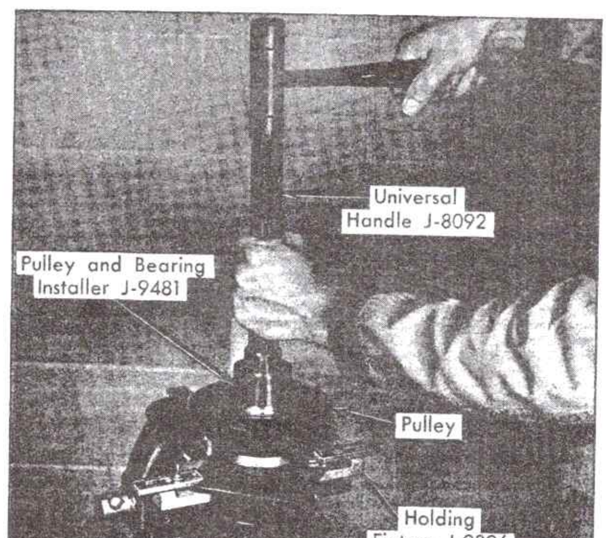


Fig. 1-36 Installing Pulley and Bearing Assembly

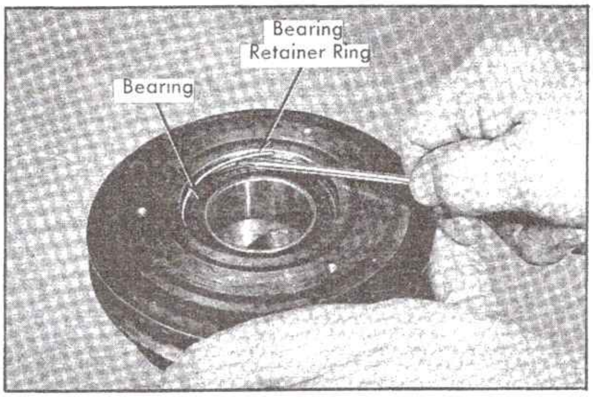


Fig. 1-37 Removing Pulley Bearing Retainer Ring

35. Compressor Pulley Bearing Replacement (Can be performed on car)

1. Remove clutch plate and hub assembly as described in Note 33a.

2. Remove pulley and bearing assembly as described in Note 34a.

3. Remove pulley bearing retainer ring with a small screwdriver or pointed tool, Fig. 1-37.

4. Place pulley and bearing assembly on inverted Support Block, J-9521, and, using Pulley Bearing Remover, J-9398, with Universal Handle, J-8092, drive bearing assembly out of pulley, Fig. 1-38.

5. Install new bearing in pulley using Pulley and Bearing Installer, J-9481, with Universal Handle, J-8092, Fig. 1-39. The tool will apply the force to the outer race of the bearing.

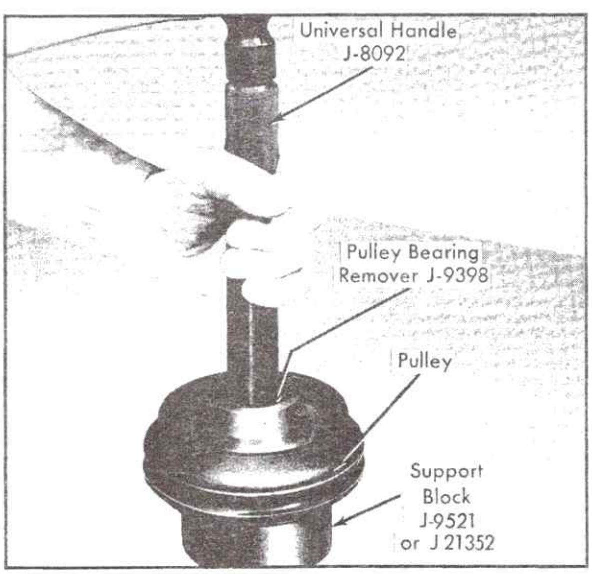


Fig. 1-38 Removing Bearing from Pulley

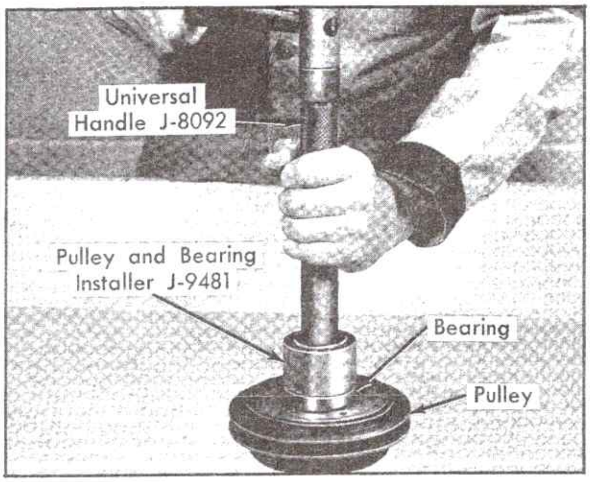


Fig. 1-39 Installing Bearing In Pulley

NOTE: Do not clean new bearing assembly with any type of solvent. Bearing is supplied with correct lubricant when assembled and requires no other lubricant at any time.

6. Install bearing retainer ring, make certain that it is properly seated in ring groove.

7. Install pulley and bearing assembly as described in Note 34b.

8. Install clutch plate and hub assembly as described in Note 33b.

36. Compressor Clutch Coil and Housing Assembly (Can be performed on car)

The coil has 3.85 ohms resistance on 80°F (ambient temperature) and should draw 3.2 amps at 12 volts.

a. Removal

1. Remove clutch plate and hub assembly as described in Note 33a.

2. Remove pulley and bearing assembly as described in Note 34a.

3. Note position of terminals on coil housing and scribe location on compressor front head casting.

4. Remove coil housing retainer ring using Snap Ring Pliers, J-6435 (#26), Fig. 1-40.

5. Lift coil and housing assembly off compressor.

b. Installation

1. Position coil and housing assembly on compressor front head casting so electrical terminals

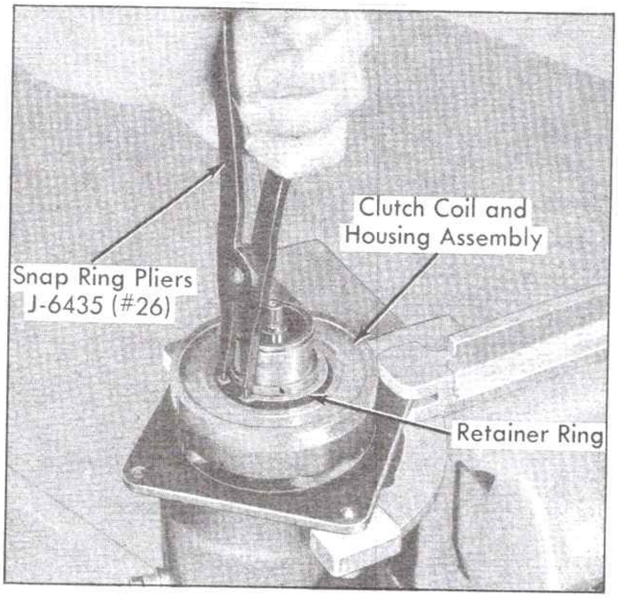


Fig. 1-40 Removing Coil Housing Retainer Ring

line up with marks previously scribed on compressor.

2. Align locating extrusions on coil housing with holes in front head casting.

3. Install coil housing retainer ring, with flat side of ring facing coil, using Snap Ring Pliers, J-6435 (#26).

4. Install pulley and bearing assembly as described in Note 34b.

5. Install clutch plate and hub assembly as described in Note 33b.

37. Compressor Shaft Seal Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 33a.

2. Clean neck of compressor.

3. Using a hook remove seal retainer and seal sleeve.

4. Remove seal seat retainer ring using Snap Ring Pliers, J-5403 (#21), Fig. 1-41.

NOTE: Illustration shows coil and housing removed, however, this is not necessary.

5. Remove seal seat using Seal Seat Remover and Installer, J-9393, Fig. 1-42. Grasp seal seat with tool flanges and pull straight up on end of tool to remove seal seat.

6. Remove shaft seal assembly using Seal Remover and Installer, J-9392, Fig. 1-43. Press

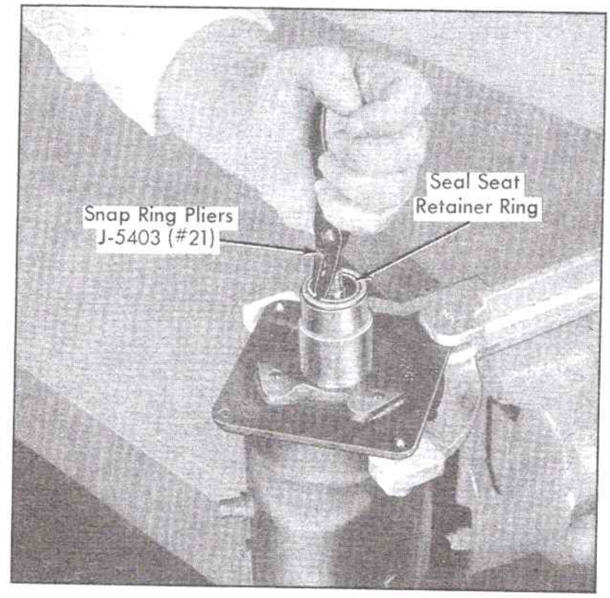


Fig. 1-41 Removing Seal Seat Retainer Ring

down on tool to overcome seal spring pressure and twist tool clockwise to engage tabs on seal assembly with locking tangs on tool. Remove seal assembly by pulling straight out from shaft.

7. Remove O-ring from interior of front head casting bore. A wire with a hook formed on the end may be used, Fig. 1-44.

b. Installation

1. Check front head casting bore for carbon chips of old seal or other foreign material. Clean bore thoroughly before installing new seal.

2. Install new O-ring seal in groove in front head casting bore, making certain that O-ring is installed in bottom groove, Fig. 1-45. Top groove is for retainer ring.

3. Immerse shaft seal in clean compressor oil before installing, to prevent shoulder from damaging O-ring.

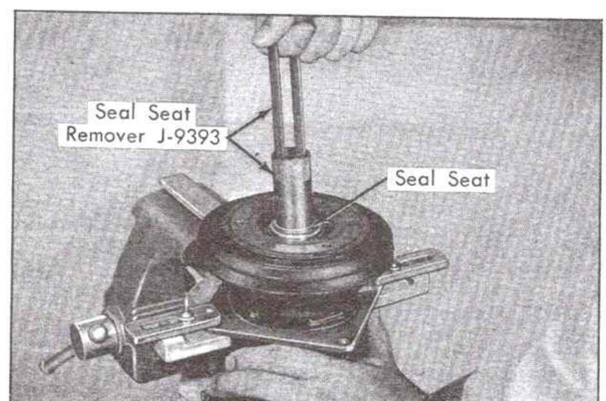


Fig. 1-42 Removing Seal Seat

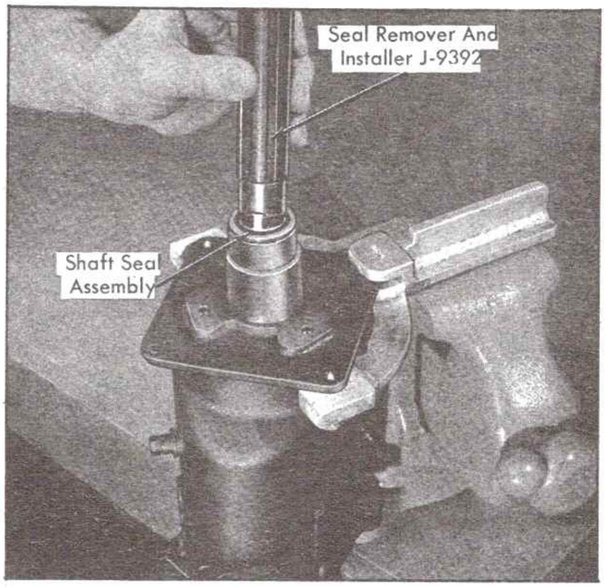


Fig. 1-43 Removing Shaft Seal Assembly

4. Install shaft seal over flats on shaft with carbon seal up, using Seal Remover and Installer, J-9392. Turn tool counterclockwise to release it from seal tabs and remove tool.

5. Insert seal seat into front head casting bore until it contacts shaft seal, being careful not to dislodge O-ring in bore.

CAUTION: Contact surface of seal seat must be protected against any damage, such as scratches and nicks. Even finger markings may cause surfact damage.

6. Insert seal seat retainer ring, flat side down, into bore, using Snap Ring Pliers, J-5403 (#21), until retainer rests on seal seat.

7. Remove snap ring pliers and, using Seal Seat

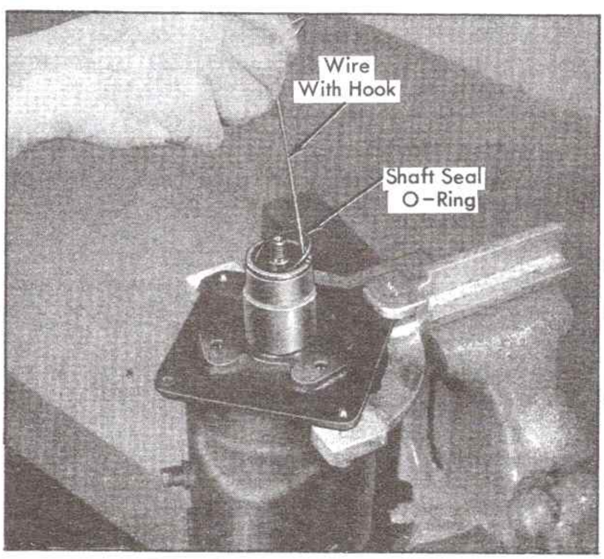


Fig. 1-44 Removing Shaft Seal O-Ring

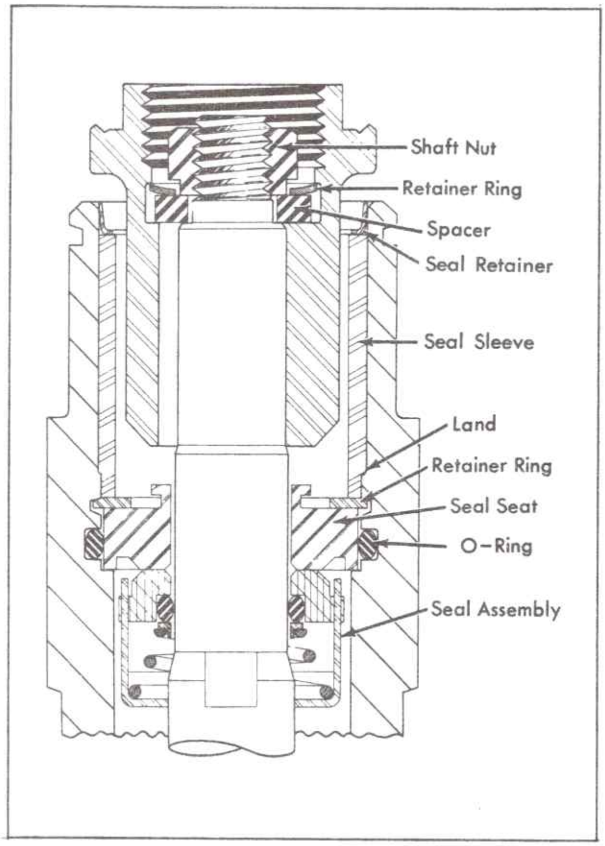


Fig. 1-45 Shaft Seal & Seal Seat Installed

Remover and Installer, J-9393, press down on retainer ring until spring pressure of shaft seal is overcome and retainer ring snaps into its groove in casting bore, Fig. 1-45.

NOTE: The chamfer that can be seen from the shaft end is a land, not a groove, Fig. 1-45.

8. Roll new felt seal sleeve along its longest length into a cylinder with the ends overlapping.

9. Insert seal sleeve into neck of compressor with overlapping ends toward top of compressor.

10. Using a small screwdriver spread felt removing the overlap so that ends will butt.

11. Position metal retainer in place and using the sleeve from J-9393 seal seat remover and a soft faced hammer, tap the retainer in until it is flush with neck of compressor, Fig. 1-45.

12. Install clutch plate and hub assembly as described in Note 33b.

13. Perform compressor leak test as described in Note 44.

38. Compressor Overhaul

Whenever a major overhaul or rebuild is performed on a compressor it is essential that the

recommended service tools be available in order to perform the various service operations properly. In addition, an adequate supply of service parts should be available. Service parts should include the following.

1. Standard size piston drive balls.

2. Shoe discs - total of 11 sizes, including the ZERO shoe.

3. Thrust races - total of 16 sizes, including the ZERO race.

4. Pistons.

5. Main shaft needle bearings.

6. Thrust bearings.

7. Compressor shaft, swash plate and woodruff key assembly.

8. Service cylinder assembly - front, rear halves, with main bearing in place and halves dowel pinned together.

9. Major internal mechanism assembly.

10. Suction reed valve - front, rear.

11. Discharge valve assembly - front, rear.

12. Gasket service kit - containing all gaskets, seals, O-rings, etc.

13. Shaft seal kit.

14. Nuts - head to shell and shaft.

15. Retainer rings.

16. Cylinder locator pins.

17. Valve and head locator pins.

18. Service type discharge cross-over tube kit.

All service parts are protected by a preservation process and packaged in a manner that will eliminate the necessity of cleaning, washing or flushing of parts to remove preservation materials. Parts can be used in mechanism assembly just as they are removed from service package.

Certain parts are identified on the piece part to denote their size or dimension. This applies to piston shoe discs and shaft thrust races.

Gasket service kit contains shaft seal O-ring, head to shell O-rings, oil tube inlet O-ring, and discharge crossover tube O-ring. This kit should be used to replace all seals and gaskets whenever a compressor is overhauled or an individual component is replaced.

There is an optional method of handling one of the major internal components -- the cylinder assembly. A service cylinder assembly, including bearings, and both front and rear halves of cylinders mated together, is available for service.

There may be occasions where it would be desirable to use this assembly rather than the complete internal assembly. In case it is used, the gaging and parts selection operations will have to be performed as described in Note 41.

An inspection should be made of the internal mechanism assembly to determine if any service operations should be performed. A detailed inspection of parts should be made to determine if it is economically feasible to replace them. It may be more economical to replace the entire internal mechanism assembly rather than replace parts.

Before proceeding with disassembly, wipe exterior surface of compressor clean.

All oil in compressor should be drained and measured. Assist draining by positioning compressor with oil drain plug down, open suction connector and rotate drive shaft several times.

39. Compressor Internal Mechanism Removal

1. Remove clutch plate and hub assembly as described in Note 33a.

2. Remove pulley and bearing assembly as described in Note 34a.

3. Remove clutch coil and housing assembly as described in Note 36a.

4. Remove shaft seal as described in Note 37a.

5. Invert compressor and Holding Fixture, J-9396, with front end of compressor shaft down.

NOTE: Additional oil may leak from compressor at this time. All oil must be drained into a containter so that total amount can be measured. A liquid measuring cup may be used for this purpose. Drained oil should then be discarded.

6. Remove four locknuts from threaded studs on compressor shell and remove rear head.

NOTE: Tap uniformly around rear head if head is binding.

7. Wipe excess oil from all teflon gasket surfaces on rear head casting webs, and examine

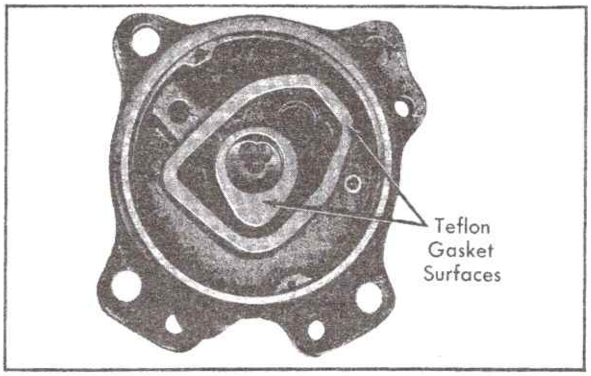


Fig. 1-46 Teflon Gasket Surfaces on Rear Head

gasket surfaces, Fig. 1-46. If any damage is observed, head should be replaced.

8. Remove suction screen and examine for any damage or contamination. Clean or replace if necessary.

9. Paint an identifying mark (prussian blue or other suitable marking material may be used) on exposed face of inner and outer oil pump gears and then remove gears.

NOTE: Identifying marks are to assure that gears, if reused, will be installed in identical position.

10. Remove and discard rear head to shell O-ring.

11. Carefully remove rear discharge valve plate assembly. Use two small screwdrivers under reed retainers and pry up on assembly, Fig. 1-47. Do not position screwdrivers between reeds and reed seats.

12. Examine valve reeds and seats. Replace entire assembly if any reeds or seats are damaged.

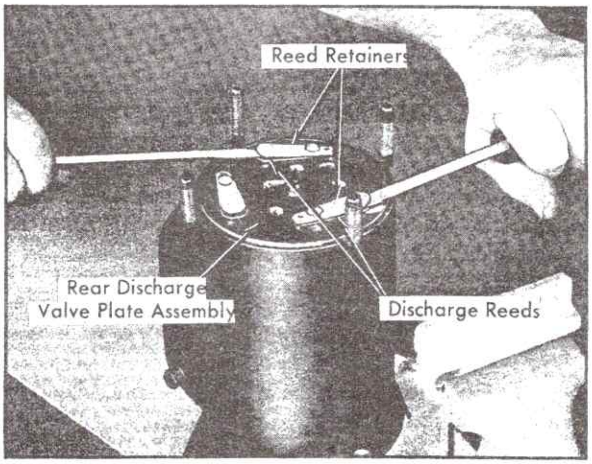


Fig. 1-47 Removing Rear Discharge Valve Plate

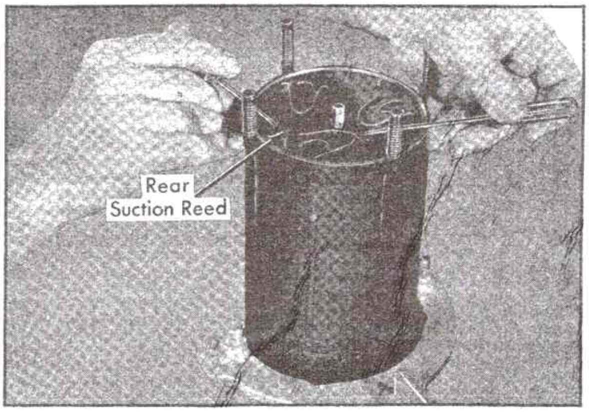


Fig. 1-48 Removing Rear Suction Reed

13. Using two small screwdrivers, carefully remove rear suction reed, Fig. 1-48. Do not pry up on horseshoe shaped reed valves.

14. Examine reeds for damage, and replace if necessary.

15. Using Oil Pick-Up Tube Remover, J-5139, Fig. 1-49, remove oil pick-up tube. Remove O-ring from oil inlet.

16. Loosen compressor from Holding Fixture, place Internal Assembly Support Block, J-9521, over oil pump shaft and, holding Support Block in position with one hand, lift compressor from Holding Fixture with other hand. Invert compressor and position on bench with Internal Assembly Support Block resting on bench.

17. Lift front head and compressor shell assembly up, leaving internal mechanism resting on Internal Assembly Support Block.

CAUTION: Do not tap on end of compressor shaft to remove internal mechanism. If mechanism will not slide out of compressor shell, tap on front head with a plastic hammer.

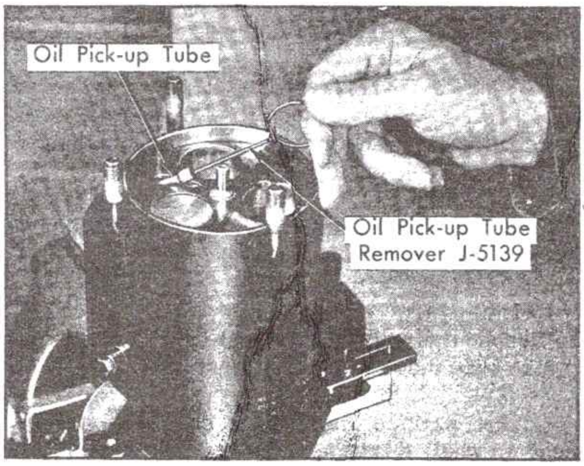


Fig. 1-49 Removing Oil Pick-Up Tube

18. Rest compressor shell on its side and push front head assembly through compressor shell, being careful not to damage teflon sealing areas on inner side of front head. Discard O-ring.

NOTE: It may be necessary to tap on outside of front head, using a plastic hammer, to overcome friction of O-ring seal between front head and compressor shell.

19. Wipe excess oil from teflon gasket surface on front head casting webs and examine gasket surface. If any damage is observed, head should be replaced.

20. Remove front discharge valve plate assembly and front suction reed plate. Examine reeds and seats. Replace necessary parts.

21. Remove suction cross-over cover by prying with screwdriver between cylinder casting and cover.

NOTE: Examine internal mechanism for any obvious damage. If internal mechanism has sustained major damage, due to loss of refrigerant or oil, it may be necessary to use the service internal mechanism assembly rather than replace individual parts.

40. Compressor Internal Mechanism Disassembly

Use Parts Tray, J-9402, to retain compressor parts during disassembly.

1. Remove internal mechanism from compressor as described in Note 39.

2. Identify by a pencil mark, or some other suitable means, each piston numbering them 1, 2, and 3, Fig. 1-50. Number the piston bores in the front cylinder half in like manner so that pistons can be replaced in their original locations.

3. Separate cylinder halves, using a wood block and mallet, Fig. 1-51. Make certain that discharge cross-over tube does not contact swash plate when separating cylinder halves.

CAUTION: Under no circumstances should shaft be struck at either end in an effort to separate upper and lower cylinder halves.

4. Position complete internal mechanism, rear cylinder down, on Support Block, J-9521, and remove front cylinder half.

5. Pull up on compressor shaft and remove piston previously identified as #1, with balls and shoe discs, from swash plate.

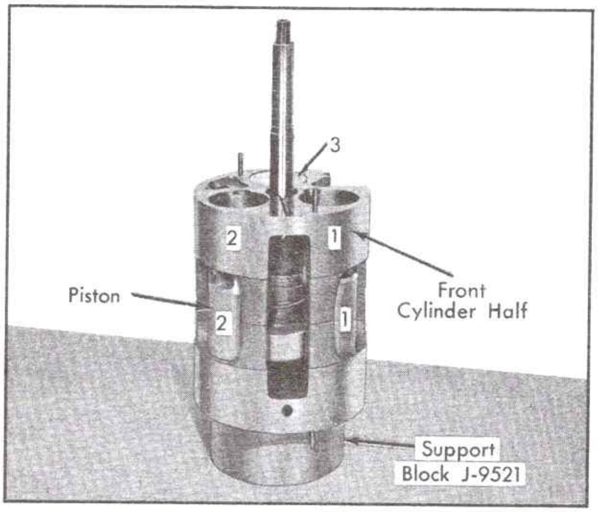


Fig. 1-50 Numbering Pistons & Cylinder Bores

6. Remove and discard piston shoe discs.

7. Remove and examine piston balls, and if satisfactory for re-use, place balls in #1 compartment of Parts Tray.

8. Remove piston rings and examine for re-use. If satisfactory, place in proper slots below #1 piston in Parts Tray.

9. Place piston in #1 compartment of Parts Tray with notch in casting web at front end of piston in dimpled groove of compartment, Fig. 1-52.

10. Repeat steps 5 through 9 for pistons #2 and #3.

11. Remove front combination of thrust races and thrust bearing from shaft, Fig. 1-53. Discard races and place bearing in front bearing slot of Parts Tray.

12. Remove shaft assembly from rear cylinder half. It may be necessary to bend discharge cross-over tube slightly in order to remove shaft.

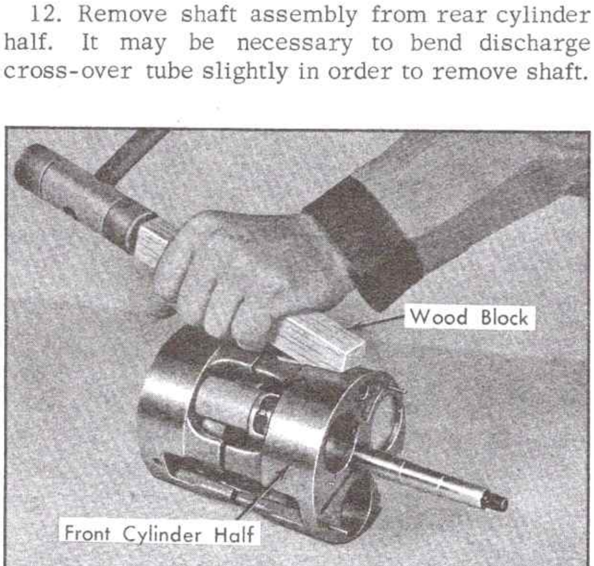


Fig. 1-51 Separating Cylinder Halves

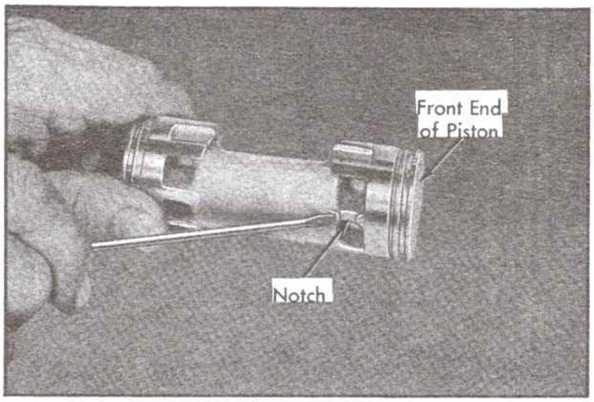


Fig. 1-52 Compressor Piston

13. Remove rear combination of thrust races and bearing from shaft. Discard races and place bearing in rear bearing slot in Parts Tray.

14. Examine surface of swash plate and shaft. Replace as an assembly, if necessary. Examine front and rear thrust bearings and replace if necessary.

NOTE: A certain amount of shoe disc wear on swash plate is normal as well as some markings indicating load of needle bearings on shaft.

15. Remove discharge cross-over tube from cylinder half, using vise grip pliers.

NOTE: This is necessary only on original factory equipment as ends of the tube are swedged into cylinder halves. The discharge cross-over tube in internal mechanism assemblies that have been previously serviced have an O-ring and bushing at each end of the tube, and can be easily removed by hand.

16. Examine piston bores and needle bearings in front and rear cylinder halves. Replace front and rear cylinders if any cylinder bore is deeply scored or damaged.

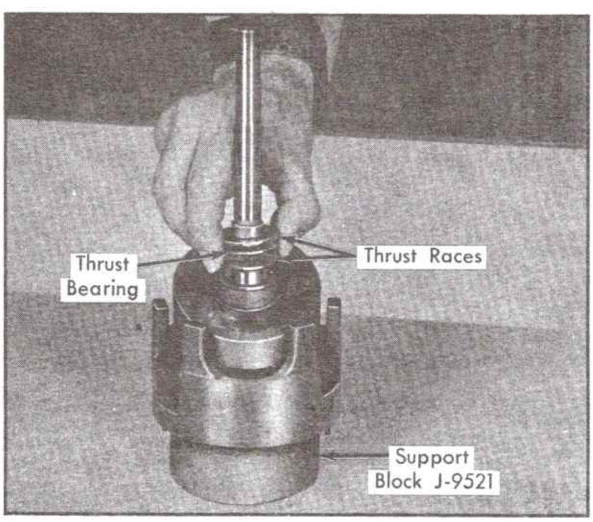


Fig. 1-53 Removing Front Thrust Races & Thrust Bearing

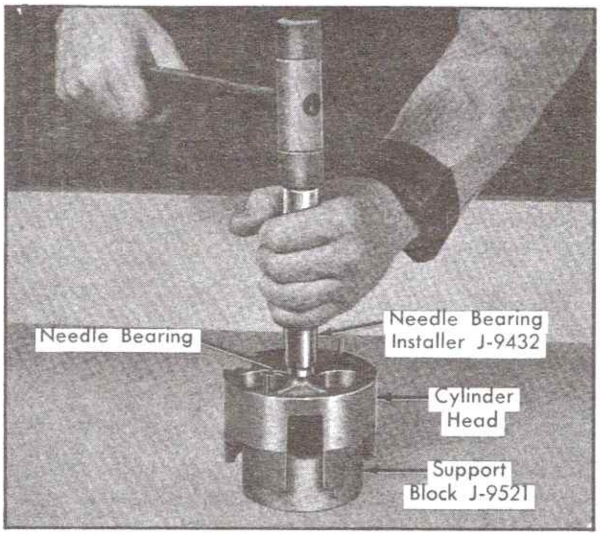


Fig. 1-54 Installing Needle Bearing

17. Needle bearings may be removed if necessary by driving them out with special Thin Wall Socket, J-9399. Insert socket in hub end (inner side) of cylinder head and drive bearing out. To install needle bearing, place cylinder half on Support Block, hub end down, and insert bearing in end of cylinder head with bearing identification marks up. Use Needle Bearing Installer, J-9432, and drive bearing into cylinder head, Fig. 1-54, until tool bottoms on cylinder face.

18. Wash all parts to be re-used with trichlorethylene, alcohol, or a similar solvent. Air dry parts using a source of clean dry air.

41. Compressor Internal Mechanism Gaging Operation

1. Install Compressing Fixture, J-9397, on Holding Fixture, J-9396, in vise. Place front cylinder half in Compressing Fixture, flat side down.

2. Secure from service parts stock four zero thrust races and three zero shoe discs.

3. Install a zero thrust race, thrust bearing, and a second zero thrust race on front end of compressor shaft. Lubricate races and bearing with petrolatum.

4. Insert threaded end of shaft through needle bearing in front cylinder half, and allow thrust race and bearing assembly to rest on hub of cylinder.

5. Install a zero thrust race on rear end of compressor shaft so that it rests on hub of swash

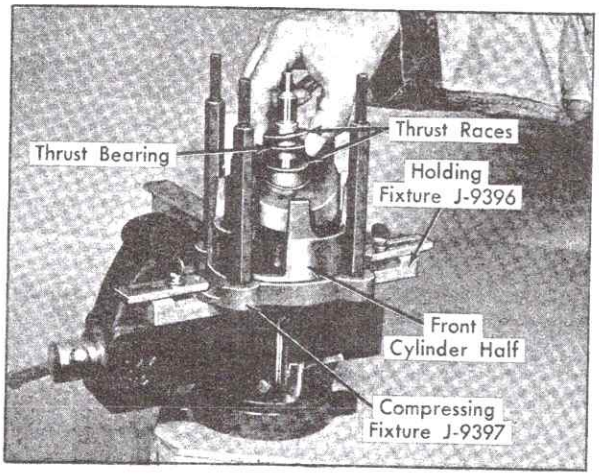


Fig. 1-55 Installing Rear Thrust Races & Thrust Bearing

plate. Then install thrust bearing and a second zero thrust race, Fig. 1-55. Lubricate races and bearing with petrolatum.

6. Lubricate ball pockets of the #1 piston with refrigeration oil and place a ball in each socket. Use balls previously removed if they are to be re-used.

7. Lubricate cavity of a zero shoe disc with refrigeration oil and place shoe disc over ball in front end of piston, Fig. 1-56. Front end of piston has an identifying notch in casting web.

NOTE: Piston rings should not be installed at this time.

8. Rotate shaft and swash plate until high point of swash plate is over #1 piston cylinder bore.

9. Lift shaft assembly and hold front thrust race and bearing assembly against swash plate hub.

10. Position piston over #1 cylinder bore (notched end of piston on bottom and piston straddling swash plate) and lower the shaft to allow piston to drop into its bore, Fig. 1-57.

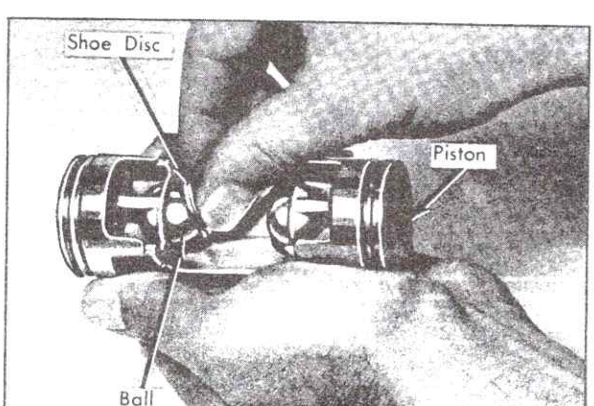


Fig. 1-56 Installing Shoe Disc

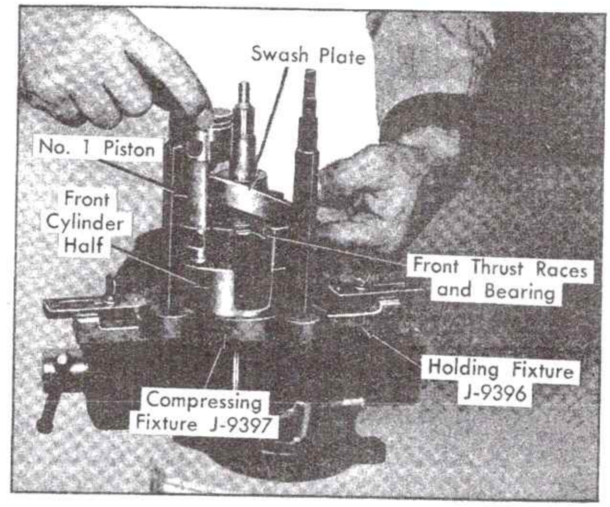


Fig. 1-57 Installing Piston

11. Repeat steps 6 through 10 for pistons #2 and #3.

12. Install rear cylinder half on pistons, aligning cylinder with discharge cross-over tube hole in front cylinder. Tap into place using a plastic mallet.

13. Position discharge cross-over tube holes between a pair of Compressing Fixture bolts to permit access for feeler gage.

14. Install top plate on Compressing Fixture, J-9397. Tighten nuts to 15 foot-pounds torque using a 0-25 foot-pounds torque wrench.

15. Measure clearance between rear ball of #1 piston and swash plate, in following manner:

a. Select a suitable combination of well-oiled feeler gage leaves to fit snugly between ball and swash plate.

b. Attach a spring scale reading in 1 ounce increments to the feeler gage. A distributor point checking scale or Spring Scale, J-544-A may be used.

c. Pull on spring scale to slide feeler gage stock out from between ball and swash plate, and note reading on spring scale as feeler gage is removed, Fig. 1-58. Reading should be between 4 and 8 ounces.

d. If reading in step (c) is under 4 or over 8 ounces, reduce or increase thickness of feeler gage leaves and repeat steps (a) through (c) until a reading of 4 to 8 ounces is obtained. Record clearance between ball and swash plate that results in a 4 to 8 ounce pull on spring scale.

16. Rotate shaft 120° and repeat step 15 between same ball and swash plate. Record this measurement.

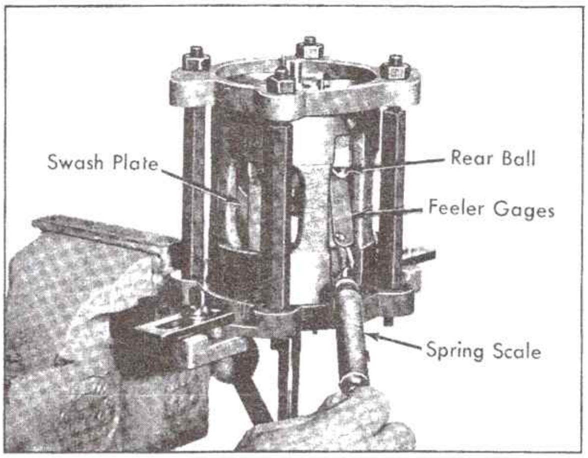


Fig. 1-58 Gaging Rear Piston Ball

17. Rotate shaft 120° and again repeat step 15 between these same parts and record measurement.

18. Select a numbered shoe disc corresponding to minimum feeler gage reading recorded in the three checks. Place shoe discs in Parts Tray, in compartment corresponding to piston #1 and rear ball pocket position.

NOTE: Shoe discs are provided in .0005 inch (one-half thousandths) variations. There are a total of eleven sizes available for field servicing. All shoe discs are marked with the shoe size, which corresponds to the last three digits of the piece part number. See shoe disc size chart.

Last 3 Digits of Part No.	No. Stamped on Shoe
000	0
175	17-1/2
180	18
185	18-1/2
190	19
195	19-1/2
200	20
205	20-1/2
210	21
215	21-1/2
220	22

Once proper selection of shoe has been made, the matched combination of shoe disc to rear ball and spherical cavity in piston must be kept in proper relationship during disassembly after gaging operation, and during final assembly of internal mechanism.

19. Repeat in detail the same gaging operation outlined in steps 15 through 18 for pistons #2 and #3.

20. Mount Dial Indicator, J-8001-3, on edge of Compressing Fixture with Clamp, J-8001-1, and Sleeve, J-8001-2, Fig. 1-59. Position Dial Indicator on rear end of shaft and adjust to zero. Push front end of shaft upward and record measurement.

NOTE: Dial Indicator increments are .001 inch; therefore, reading must be estimated to nearest .0005 inch.

21. Select a thrust race with a number corresponding to the amount of end play shown. Place thrust race in right hand slot at bottom center of Parts Tray.

NOTE: Fifteen thrust races are provided in increments of .0005 inch (one-half thousandths) thickness and one zero gage thickness providing a total of 16 sizes available for field service. Thrust races are identified on the part by their thickness in thousands in excess of the thickness of the zero thrust race.

THRUST RACE SIZE CHART

Last 3 Digits of Part No.	No. Stamped on Thrust Race
000	0
050	5
055	5-1/2
060	6
065	6-1/2
070	7
075	7-1/2
080	8
085	8-1/2
090	9
095	9-1/2
100	10
105	10-1/2
110	11
115	11-1/2
120	12

This number also corresponds to the last three digits of the piece part number. See thrust race size chart.

A tolerance of .0005 inch to .0015 inch is built into thrust races to provide a running clearance between hub surfaces of swash plate and front and rear hubs of cylinder.

22. Remove nuts from top plate of Compressing Fixture, and remove top plate.

23. Separate cylinder halves while unit is in fixture. It may be necessary to use a wood block and mallet.

24. Remove rear cylinder half and carefully remove one piston at a time from swash plate and

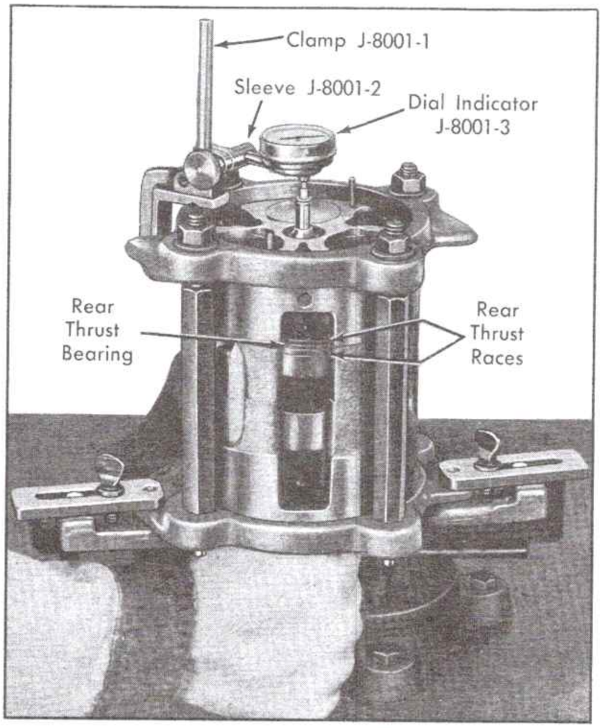


Fig. 1-59 Gaging Rear Thrust Race

front cylinder half. Do not lose the relationship of the front ball and shoe disc and rear ball. Transfer each piston, ball, and shoe disc to its proper place in Parts Tray.

25. Remove rear outer zero thrust race from shaft and install thrust race previously selected.

NOTE: The zero thrust race may be put aside for re-use in additional gaging or rebuilding operations.

42. Compressor Internal Mechanism Assembly

1. Install a piston ring on each end of #1 piston, with scraper groove toward center of piston.

2. Lubricate ball pockets of piston with refrigeration oil and place the corresponding balls from the Parts Tray in each pocket.

3. Lubricate cavities of #1 piston shoe discs with refrigeration oil and place zero shoe disc over ball in front end of piston and numbered shoe disc over ball in rear end of piston.

4. Rotate shaft and swash plate until high point of swash plate is over #1 piston cylinder bore.

NOTE: Make certain that front thrust race and bearing assembly adhere to swash plate hub.

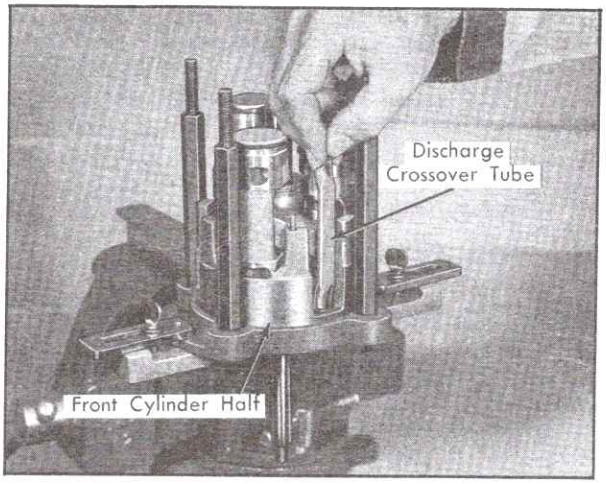


Fig. 1-60 Installing Discharge Cross-Over Tube

5. Position piston over #1 cylinder bore with notched end of piston on bottom and piston straddling swash plate and lower shaft to allow piston to drop into its bore.

6. Position piston ring gap toward shaft, compress ring and lower ring into front cylinder half.

7. Repeat steps 1 through 6 for pistons #2 and #3.

8. Install new discharge cross-over tube in front cylinder half with bridged surface facing outboard, Fig. 1-60. Make certain that end of tube is properly centered in hole in front cylinder half.

NOTE: The service discharge cross-over tube is similar to the production type tube except that an O-ring and bushing is used at each end, Fig. 1-61. Do not install O-ring or bushing at this time.

9. Rotate shaft to position pistons in a stair-step arrangement. Position rings on each piston so that ring gaps are toward shaft, then push rings as far outboard as possible.

10. Place rear cylinder half over shaft and start pistons and rings into cylinder bores.

11. When all three pistons and rings are in their respective bores, align end of discharge cross-over tube with hole in rear cylinder half.

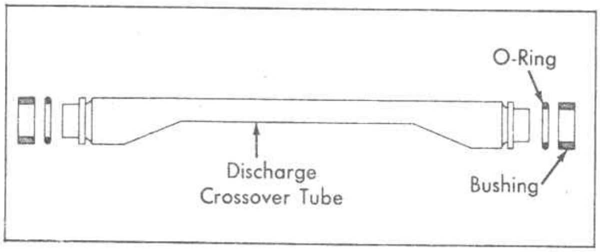


Fig. 1-61 Service Type Cross-over Tube

Make certain that bridged surface of tube faces outboard for swash plate clearance.

12. When satisfied that all parts are in proper alignment, tap rear cylinder half with a mallet to seat it over the locating dowel pins.

13. Remove internal mechanism from fixture and place on bench.

14. Bending suction cross-over cover slightly, start it into one end of dove tail slot in cylinder halves. Align cover with ends of cylinder faces by gently tapping end of cover with a plastic hammer.

43. Compressor Internal Mechanism Installation

1. Place internal mechanism on Internal Assembly Support Block J-9521, with rear end of shaft in block hole.

2. Install new O-ring and bushing on front end of discharge cross-over tube, Fig. 1-62. The O-ring and bushing are service parts only for internal mechanisms that have been disassembled in the field.

3. Install new dowel pins in front cylinder half, if previously removed.

4. Install front suction reed plate on front cylinder half. Align with dowel pins, suction ports, oil return slot, and discharge cross-over tube, Fig. 1-63.

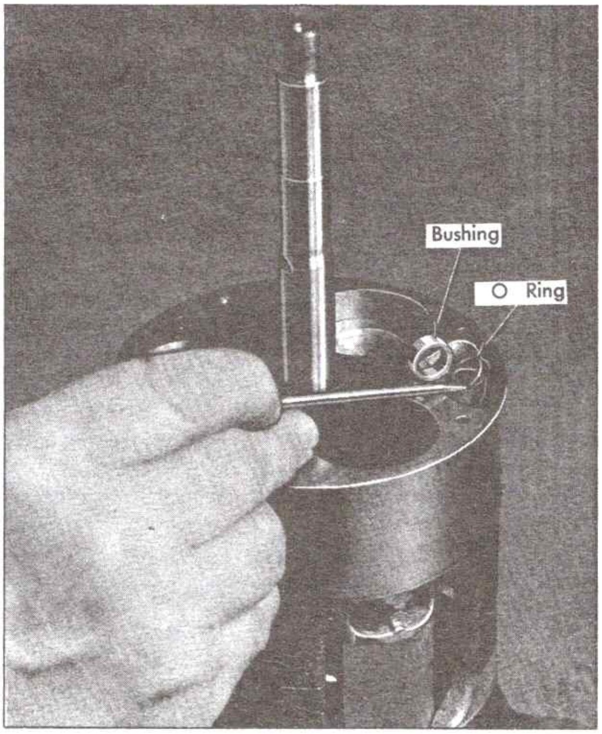


Fig. 1-62 Installing O-Ring on Cross-over Tube

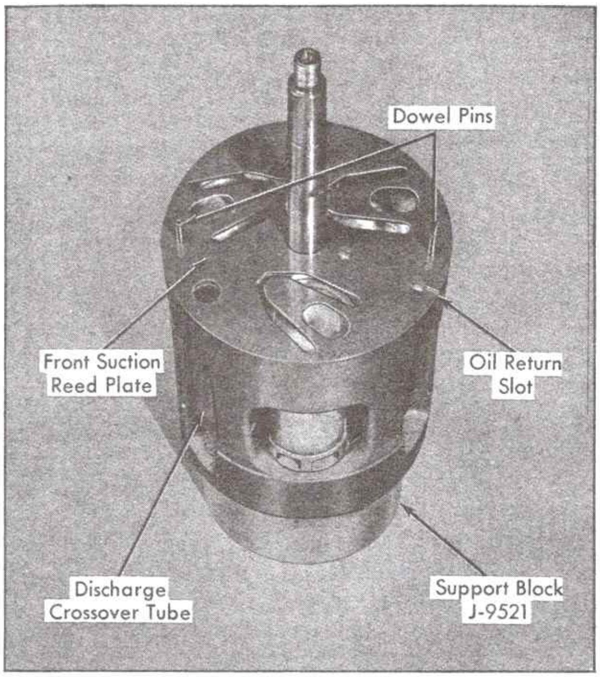


Fig. 1-63 Installing Front Suction Reed

5. Install front discharge valve plate assembly, aligning holes with dowel pins and proper openings in front suction reed plate, Fig. 1-64.

NOTE: Front discharge plate has a large diameter hole in the center, Fig. 1-65.

6. Coat teflon gasket surfaces on webs of compressor front head casting with 525 viscosity refrigeration oil.

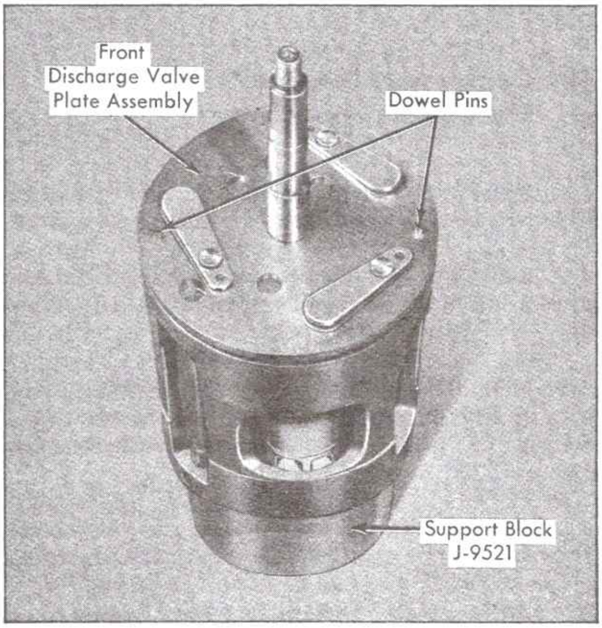


Fig. 1-64 Installing Front Discharge Valve Plate

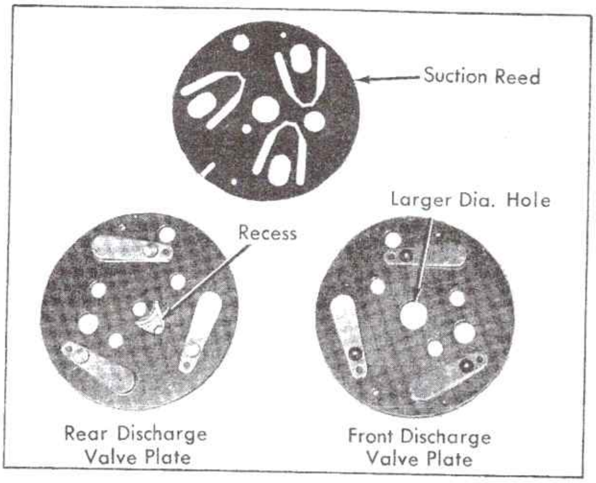


Fig. 1-65 Front & Rear Discharge Valve Plates

7. Determine exact position of front head casting in relation to dowel pins on internal mechanism. Mark position of dowel pins on sides of front head assembly and on sides of internal mechanism with a grease pencil. Carefully lower front head casting into position, Fig. 1-66, making certain that teflon sealing area around center bore of head assembly does not contact shaft as head assembly is lowered. Do not rotate head assembly to line up with dowel pins, as teflon sealing areas would contact reed retainers.

8. Generously lubricate angled groove at lower edge of front head casting with 525 viscosity refrigeration oil and install new O-ring in groove, Fig. 1-67.

9. Coat inside machine surfaces of compressor shell with 525 viscosity refrigeration oil and position shell on internal mechanism, resting on O-ring seal.

10. Using flat side of a small screwdriver, gently press O-ring in around circumference of

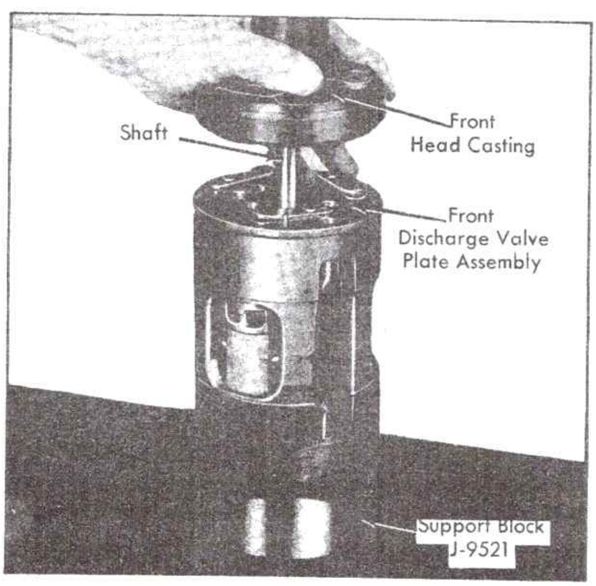


Fig. 1-66 Installing Front Head Casting

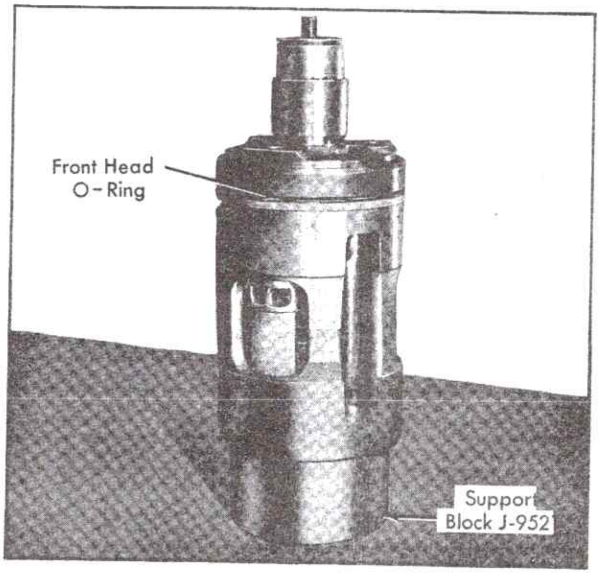


Fig. 1-67 Front Head O-Ring Installed

internal mechanism until compressor shell slides down over internal mechanism. As shell slides down, line up oil sump with oil intake tube hole, Fig. 1-68.

11. Holding support block, invert assembly and place in holding fixture with front end of shaft down. Remove support block.

12. Install new dowel pins in rear cylinder half if previously removed.

13. Install new O-ring in oil pick-up tube cavity.

14. Lubricate oil pick-up tube and install in cavity, rotating compressor mechanism to align tube with hole in shell baffle, Fig. 1-69.

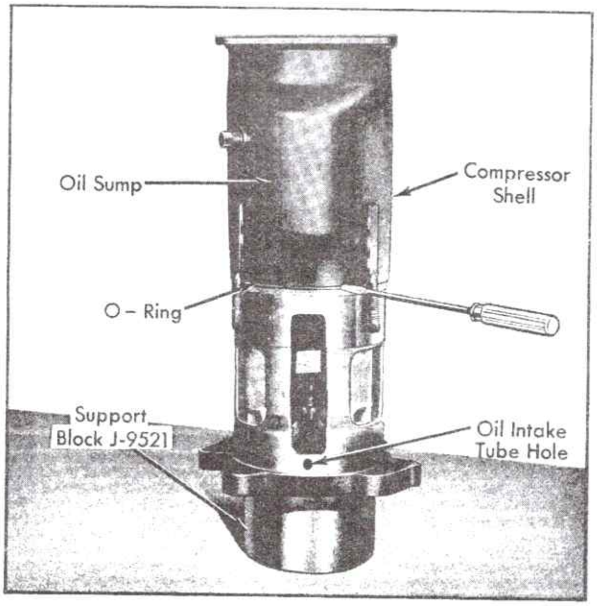


Fig. 1-68 Installing Compressor Shell

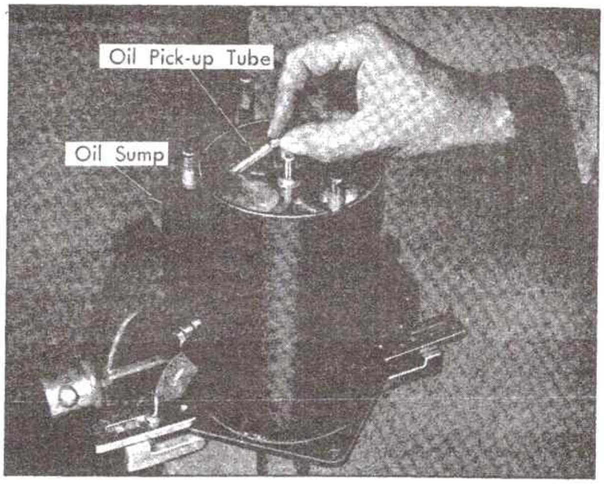


Fig. 1-69 Installing Oil Pick-Up Tube

15. Install new O-ring and bushing on rear of discharge cross-over tube.

16. Install rear suction reed over dowel pins with slot toward sump.

17. Install rear discharge valve plate assembly over dowel pins with reed retainers up.

18. Position inner oil pump gear over shaft with previously applied identification mark up.

19. Position outer oil pump gear over inner gear with previously applied identification mark up and, when standing facing oil sump, position outer gear so that it meshes with inner gear at the 9 o'clock position and cavity between gear teeth is at 3 o'clock position, Fig. 1-70.

20. Generously oil rear discharge valve plate assembly around outer edge where large diameter O-ring will be placed. Oil valve reeds, pump gears, and area where teflon sealing surface will contact rear discharge valve plate.

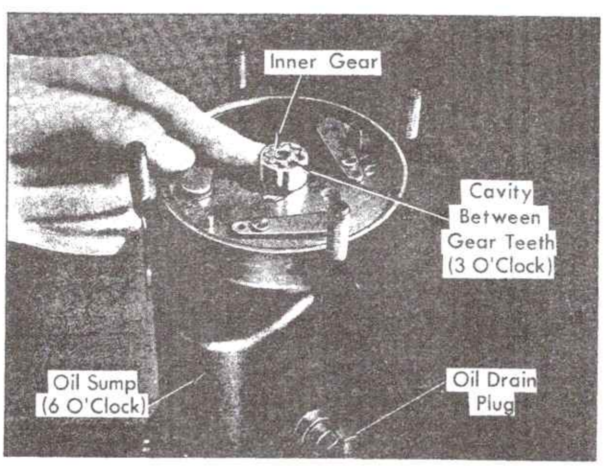


Fig. 1-70 Positioning Oil Pump Gears

21. Lubricate new head-to-shell O-ring and install on rear discharge valve plate, in contact with shell.

22. Install suction screen in rear head casting, using care not to damage screen.

23. Coat teflon sealing surface on webs of compressor rear head casting with 525 viscosity refrigeration oil.

24. Install rear head assembly over studs on compressor shell. The two lower threaded compressor mounting holes should be in alignment with the compressor sump. Make certain that suction screen does not drop out of place when lowering rear head into position.

NOTE: If rear head assembly will not slide down over dowels in internal mechanism, twist front head assembly back and forth very slightly by hand until rear head drops over dowel pins.

25. Install nuts on threaded shell studs and tighten evenly to 20 foot-pounds torque using a 0-25 foot-pounds torque wrench.

26. Invert compressor in holding fixture and install shaft seal as described in Note 37b.

27. Install compressor clutch coil and housing assembly as described in Note 36b.

28. Install compressor pulley and bearing assembly as described in Note 34b.

29. Install compressor clutch plate and hub assembly as described in Note 33b.

30. Add 525 viscosity refrigeration oil as described in Note 23.

31. Check for external and internal leaks as described in Note 44.

44. Compressor Leak Testing (External and Internal)

1. Rotate clutch hub clockwise several turns to pick oil up from sump and carry it to piston rings and oil seals.

2. Remove adapter plate from rear head of compressor, if not already removed, and install Test Plate, J-9527.

3. Attach center hose of gage manifold set on Charging Station to a refrigerant drum standing in an upright position and open valve on drum.

4. Connect charging station high and low pressure lines to corresponding fittings on Test Plate.

NOTE: High pressure fitting is one farthest from high pressure relief valve on compressor rear head.

5. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 4 on Charging Station to allow refrigerant vapor to flow into compressor.

6. Using Leak Detector Torch, J-6084, check for leaks at pressure relief valve, oil drain fitting, compressor rear head seal, compressor front head seal and compressor shaft seal. After checking, shut off valve 1 and valve 2 on Charging Station.

7. If an external leak is present, perform the necessary corrective procedures and repeat steps 1 through 6 to make certain leak has been corrected before proceeding with steps 8 through 12 to check for internal leaks.

8. Disconnect manifold gage hoses from test plate.

9. Connect low pressure hose of gage manifold set to high pressure fitting on Test Plate, J-9527.

10. Open charging station valve 1 (low pressure control) to allow refrigerant vapor to flow into compressor.

11. Observe reading on pressure gage then close valve 1. If gage reading drops to 10 pounds or under in 30 seconds or less, it indicates that compressor is leaking internally, at one or more of the following points:

a. Reed valves.

b. Teflon seals at front or rear head.

c. Cross-over tube.

d. Raised section on cylinder face.

12. If a leak is indicated in step 11, perform necessary corrective procedures to eliminate internal leak and repeat steps 1 through 11 to make certain external and internal leaks are corrected. If no leak was indicated, proceed with step 13.

13. Disconnect charging station from test plate.

14. Remove test plate from compressor.

45. POA Suction Throttling Valve

a. Removal

1. Purge system as described in Note 17.

2. Disconnect low pressure vapor line from suction throttling valve and cap line.

3. Disconnect oil bleed line and external equalizer line from POA suction throttling valve.

4. Remove screw securing POA suction throttling valve clamp to brace on front of blower-evaporator assembly case.

5. Disconnect fitting on evaporator outlet pipe from POA suction throttling valve and remove valve.

6. Remove clamp from POA suction throttling valve.

b. Installation

1. Install clamp on POA suction throttling valve.

2. Connect POA suction throttling valve to fitting on evaporator outlet pipe, using a new O-ring.

3. Position POA suction throttling valve clamp to brace on front of blower-evaporator assembly case, and secure with screw.

4. Using new O-rings, connect equalizer and oil bleed lines to POA suction throttling valve.

5. Connect low pressure vapor line to POA suction throttling valve, using a new O-ring.

6. Evacuate system as described in Note 19.

7. Charge system as described in Note 21, and leak test all connections.

8. Check operation of system.

46. Expansion Valve

a. Removal

1. Purge system as described in Note 17.

2. Remove insulation from power element bulb on evaporator outlet pipe and remove bulb clamp and bulb.

3. Disconnect external equalizer line from POA suction throttling valve.

4. Disconnect high pressure liquid line from expansion valve and cap line.

5. Remove screw securing expansion valve clamp to brace on front of blower-evaporator assembly case.

6. Disconnect expansion valve from evaporator inlet pipe fitting and remove expansion valve.

7. Remove clamp from expansion valve.

b. Installation

1. Install clamp on expansion valve.

2. Using a new O-ring, connect expansion valve to evaporator inlet pipe fitting.

3. Install screw securing expansion valve clamp to brace on front of blower-evaporator assembly case.

4. Connect high pressure liquid line to expansion valve, using a new O-ring.

5. Using a new O-ring, connect external equalizer line to suction throttling valve.

6. Attach power element bulb to evaporator outlet pipe and secure with clamp.

NOTE: Use new clamp, if necessary, to obtain tight fit of bulb to tubing.

7. Carefully replace insulation around power element bulb, as insulation must be packed tightly around bulb.

8. Evacuate system as described in Note 19.

9. Charge system as described in Note 21 and leak test all connections.

10. Check operation of system.

47. Blower Motor Assembly

NOTE: The blower motor, during HIGH speed operation, draws approximately 18 amps of current.

a. Removal

1. Disconnect negative cable from battery.

2. Disconnect blower motor feed wire.

3. Disconnect air hose at blower motor.

4. Remove screw securing blower motor ground wire to mounting flange and separate blower motor ground wire from screw.

5. Remove four remaining screws securing blower motor assembly to blower-evaporator assembly case and remove blower motor.

b. Installation

1. Position blower motor assembly to blower-evaporator assembly and install five screws, after installing blower motor ground wire on appropriate screw.

2. Install air hose to blower motor.

3. Connect blower motor feed wire.

4. Connect negative battery cable.

48. Blower-Evaporator Assembly

a. Removal

1. Remove carburetor air cleaner.

2. Purge system as described in Note 17.

3. Remove blower motor assembly as described in Note 47a.

4. Disconnect high pressure liquid line at expansion valve, and cap line.

5. Disconnect low pressure vapor line at suction throttling valve, and cap line.

6. Remove vacuum hoses from retaining clips on cowl, and position hoses toward engine.

7. Remove horseshoe clip retaining water control valve to mounting bracket and move water control valve, with all hoses attached to engine.

8. Remove five screws and nut except 693, six screws on 693 securing heater-air selector assembly to cowl and pull assembly away from cowl and position toward left side of car as far as possible.

9. Remove transmission dipstick (Except 693).

10. Remove seven screws and nut except 693, eight screws on 693 securing blower-evaporator assembly to cowl and remove assembly through engine compartment by pulling lower left corner toward engine and upward. Note screw securing blower motor ground wire to cowl. On 693 disconnect vacuum hoses and electrical connector from master switch before removing assembly.

b. Installation

1. Inserting blower end of assembly under right hood hinge, position blower-evaporator assembly to cowl by pushing left side of assembly downward, inward and to the right.

2. Making certain that no vacuum hoses are trapped between wheel housing and assembly, or underneath assembly, install screws securing assembly to cowl, after installing blower motor ground wire to appropriate screw.

3. Position heater-air selector assembly to cowl and to blower-evaporator assembly and install screws securing heater-air selector assembly to cowl.

4. Using body caulking compound seal units to prevent air leaks.

5. Position water control valve to mounting bracket and install horseshoe retaining clip.

6. Using a new O-ring, connect high pressure liquid line to expansion valve.

7. Connect low pressure vapor line to suction throttling valve, using a new O-ring.

8. Position vacuum hoses to retaining clips on cowl.

9. Install blower motor assembly as described in Note 47b.

10. Make sure that all vacuum hoses and electrical connectors in work area are connected securely.

11. Install carburetor air cleaner.

12. Install transmission dipstick, (except 693).

13. Evacuate system as described in Note 19.

14. Charge system as described in Note 21 and leak test all connections.

15. Check operation of system.

49. Evaporator Core

a. Removal

1. Remove blower-evaporator assembly as described in Note 48a.

2. Disconnect oil bleed line and equalizer line from suction throttling valve.

3. Disconnect suction throttling valve from evaporator outlet pipe and remove screw securing suction throttling valve clamp to brace on blower-evaporator case and remove valve.

4. Remove insulation and power element bulb from evaporator outlet pipe.

5. Disconnect expansion valve from evaporator inlet pipe, remove screw securing expansion valve clamp to brace on blower-evaporator case and remove valve.

6. Remove four screws securing front and rear sections of blower evaporator case together and remove evaporator inlet pipe shield from lower left screw.

7. Lift off front section of blower-evaporator case.

8. Remove two screws securing evaporator core to rear section of blower-evaporator case and remove evaporator core.

b. Installation

1. Position evaporator core to rear section of blower-evaporator case and secure to rear section with two screws.

2. Install sponge rubber seal around outlet pipe and oil bleed line, and install sponge rubber grommet around inlet pipe.

3. Position front section of blower-evaporator case to rear section, making certain that sponge rubber seal and grommet are properly seated, and securing with four screws after installing inlet pipe shield on lower left screw.

4. Add refrigeration oil as described in Note 23.

5. Position expansion valve clamp to brace on blower-evaporator case and connect expansion valve to evaporator inlet pipe, using a new O-ring.

6. Install screw securing expansion valve clamp to brace.

7. Position suction throttling valve clamp to brace on blower-evaporator case and connect suction throttling valve to evaporator outlet pipe, using a new O-ring.

8. Install screw suction throttling valve clamp to brace.

9. Install power element bulb on evaporator outlet pipe and replace insulation.

10. Using new O-rings, connect equalizer and oil bleed lines to suction throttling valve.

11. Install blower-evaporator assembly as described in Note 48b.

50. Master Switch (Except 693)

a. Removal

1. Disconnect vacuum hoses from master switch.

2. Disconnect electrical connector from master switch.

3. Remove two screws securing master switch mounting bracket to heater-air selector assembly and remove master switch and mounting bracket.

4. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.

2. Position master switch mounting bracket to heater-air selector assembly and install two screws securing mounting bracket to heater-air selector case.

3. Connect electrical connector to master switch.

4. Install vacuum hoses to master switch.

51. Power Servo Removal and Installation

a. Removal

1. Remove vacuum hose assembly connector from servo valve.

2. Disconnect vacuum hose from power servo vacuum power unit.

3. Disconnect electrical connector from power servo.

4. Remove horseshoe clip securing adjusting link to temperature door arm and disengage link from arm.

5. Remove three screws securing power servo to heater-air selector and remove power servo unit.

b. Installation

1. Position power servo unit to heater-air selector and secure with three screws.

2. Adjust temperature door link as described in Note 13a.

3. Connect electrical connector to power servo.

4. Install vacuum hose assembly connector on servo valve.

5. Connect vacuum hose to power servo vacuum power unit.

52. Power Servo Vacuum Valve Removal and Installation

a. Removal

1. Remove vacuum hose assembly connector from servo valve.

2. Remove four screws securing dustshield to power servo and remove dustshield.

3. Remove spring clip securing valve to mounting stud.

4. Remove screw securing valve to power servo and remove valve.

b. Installation

1. Position valve on power servo and secure with screw.

2. Install spring clip securing valve to mounting stud.

3. Position dustshield on power servo and secure with four screws.

4. Install vacuum hose assembly connector on servo valve, if valve was replaced with power servo on car.

53. Heater-Air Selector Assembly

a. Removal

1. Drain cooling system.

2. Remove carburetor air cleaner.

3. Disconnect vacuum hose connector from servo vacuum valve on power servo unit.

4. Disconnect vacuum hose from power servo vacuum power unit.

5. Disconnect electrical connector from power servo unit.

6. Disconnect vacuum hoses and electrical connector from master switch (except 693).

7. Disconnect vacuum hose from mode door vacuum power unit (except 693).

8. Remove hoses from heater inlet and outlet fittings.

9. Remove six screws securing heater-air selector to cowl and remove assembly from engine compartment.

b. Installation

1. Position heater-air selector assembly to cowl and to blower-evaporator unit and install six screws securing assembly to cowl.

2. Install vacuum hose connector to servo vacuum valve on power servo unit.

3. Install vacuum hose on power servo vacuum power unit.

4. Install electrical connector on power servo unit.

5. Install tan striped vacuum hose on mode door vacuum power unit (except 693).

6. Install vacuum hoses and electrical connector on master switch (except 693).

7. Install heater hoses on heater inlet and outlet fittings.

8. Install carburetor air cleaner.

9. Refill cooling system.

10. Check operation of system.

54. Heater Core

a. Removal

1. Remove heater-air selector assembly as described in Note 53a.

2. Remove four screws securing heater core frame to heater-air selector case.

3. Remove gasket from mounting flange of heater-air selector case.

4. Pull heater core frame, with heater core attached, away from heater-air selector case.

5. Remove rubber grommets from heater inlet and outlet fittings.

6. Remove four screws, one each corner, securing wire retaining clamps to heater core frame. Remove retaining clamps and remove core.

b. Installation

1. Position heater core to heater core frame.

2. Position wire retaining clamps over heater core ends and secure to heater core frame with four screws, one in each corner.

3. Position heater core and frame to heater-air selector case, guiding heater core fittings through openings in heater-air selector case.

4. Install four screws securing heater core frame to heater-air selector assembly.

5. Install gasket on heater-air selector mounting flange.

6. Install rubber grommets on heater inlet and outlet fittings and position grommets to seal openings in heater-air selector case.

7. Install heater-air selector assembly as described in Note 53b.

55. Transducer

CAUTION: The transducer should be handled with great care as its calibration can be destroyed by a sharp bump.

a. Removal

1. Disconnect vacuum hoses from fittings on transducer.

2. Disconnect transducer electrical connector.

3. Remove two screws securing transducer mounting bracket to dash panel and remove transducer.

b. Installation

1. Position transducer mounting bracket to dash panel and secure with two screws.

2. Connect transducer electrical connector.

3. Connect vacuum hoses to fittings on transducer.

NOTE: Vacuum hose with smallest I.D. goes on top fitting of transducer.

56. Dehydrator – Receiver

The sight glass is an integral part of the dehydrator-receiver. No service should be performed on this assembly.

a. Removal

1. Purge system as described in Note 17.

2. Disconnect condenser pipe at COND side of sight glass. Cap condenser pipe if condenser is not being replaced.

3. Disconnect high pressure liquid line at EVAP side of sight glass and cap liquid line.

NOTE: Cap fittings if original dehydrator-receiver is to be reinstalled.

4. Remove two bolts securing dehydrator-receiver clamps to condenser support bracket and remove dehydrator-receiver.

5. Remove clamps, if dehydrator receiver is being replaced.

b. Installation

NOTE: Do not uncap new assembly, except to add refrigeration oil, until it is clamped in

position, as it will quickly absorb moisture from the air, decreasing its efficiency or rendering it completely useless. Keep it capped at all times.

1. Install refrigeration oil, as described in Note 23, if new dehydrator-receiver is to be installed, and recap dehydrator-receiver.

2. Install retaining clamps, if previously removed.

3. Position dehydrator-receiver retaining clamps to condenser support bracket and secure with two bolts.

NOTE: Make certain dehydrator-receiver fittings are in line with condenser pipe and high pressure liquid line before tightening mounting bolts.

4. Remove caps from COND side of dehydrator-receiver and condenser pipe and install condenser pipe to COND fitting side of sight glass, using a new O-ring.

5. Remove caps from EVAP side of dehydrator-receiver and high pressure liquid line and install high pressure liquid line to EVAP fitting side of sight glass, using a new O-ring.

6. Evacuate system as described in Note 19.

7. Charge system with refrigerant as described in Note 21 and leak test dehydrator-receiver and condenser connections.

8. Check operation of system.

57. Condenser (Except 693)

a. Removal

1. Remove dehydrator-receiver assembly as described in Note 56a.

2. If car is equipped with Eldorado horn, remove horn.

3. Remove battery.

4. Remove retainer securing clamp retaining high pressure vapor line to radiator cradle tie bar.

5. Remove screw securing high pressure vapor line to bracket on top right side of condenser.

6. Disconnect high pressure vapor line at fitting on top right side of condenser and position vapor line out of way.

7. Remove four nuts, two each side, securing condenser mounting brackets to rubber mounts.

8. Remove nut securing upper right rubber mount to radiator cradle and remove rubber mount.

9. Pull condenser forward to disengage condenser mounting brackets from remaining rubber mounts and move condenser to the right so that upper right mounting bracket enters opening in radiator cradle created by condenser mounting flange.

10. Remove condenser by lifting left side of condenser upward and then outward.

b. Installation

1. Add refrigeration oil as described in Note 23.

2. With right side of condenser down, start to lower condenser into opening between hood latch pilot tie bar and radiator, and insert upper right mounting bracket into opening left by condenser mounting flange in radiator cradle. Then rotate left side of condenser downward into position.

3. Position upper right rubber mount to radiator cradle condenser mounting flange and secure with one nut.

4. Position condenser mounting brackets to rubber mounts and secure with four nuts, two each side.

5. Position rubber snubber at lower right mounting bracket.

6. Connect high pressure vapor line to fitting on upper right side of condenser.

7. Install screw securing high pressure vapor line bracket to bracket on top right side of condenser.

8. Position high pressure vapor line clamp over line and to radiator cradle tie bar and secure clamp with push in retainer.

9. If previously removed, install Eldorado horn.

10. Install battery.

11. Install dehydrator-receiver assembly as described in Note 56b.

FLEETWOOD SEVENTY-FIVE REAR SYSTEM

The Automatic Climate Control system used in the rear of the Fleetwood Seventy-Five Cadillac operates in the same manner as the front system. The two systems, front and rear, operate independently of each other.

This portion of the manual describes those items used exclusively on the rear system. Certain items, such as the compressor, condenser, and dehydrator-receiver, are common to both systems and will not be covered.

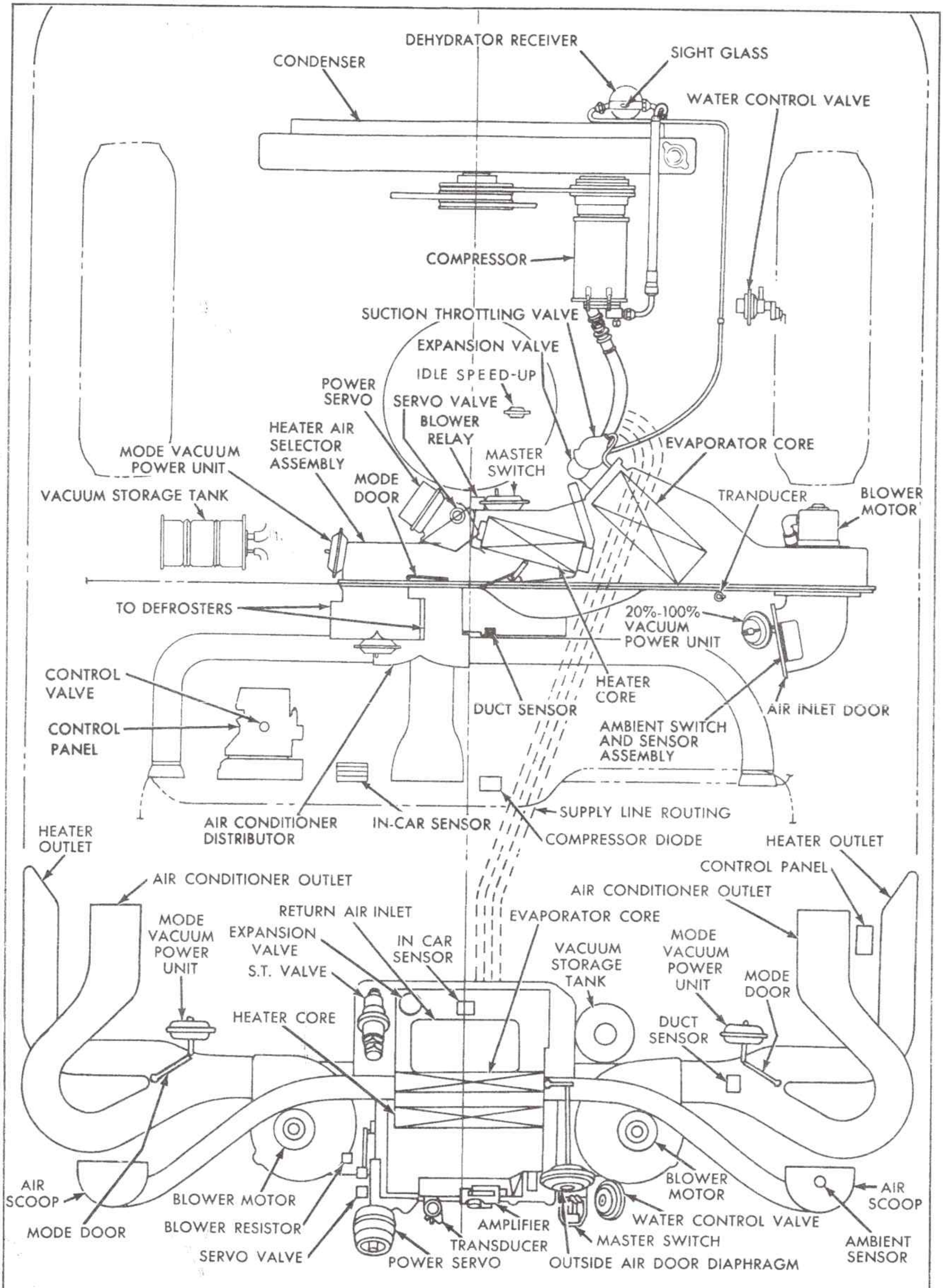


Fig. 1-71 Location of Units on 697

A complete string of sensors, an amplifier, transducer, power servo, control dial and various other parts are used in the rear system to obtain the automatic control.

Automatic Climate Control Components (697 Rear)

a. Sensors

The in-car sensor, mounted in a grill located on the rear package shelf, senses the temperature of the passenger compartment as well as the sun load on the rear of car.

The duct sensor senses the discharge air temperature. It is located in the mode door assembly on the right side of the car where it is exposed to all discharge air entering this area.

The ambient sensor is located in the right air intake scoop outside of the car. It senses the temperature of the ambient air entering the system.

b. Temperature Dial

The temperature dial is located in the right rear arm rest. The dial is graduated in 5°F divisions to allow the passenger to select any temperature in the 65°F to 85°F range.

c. Vacuum On-Off Switch

The Vacuum On-Off switch is located in the right rear arm rest behind the temperature dial. This switch allows the passenger to turn the rear system off.

d. Amplifier

The amplifier is mounted on the rear face of the rear unit case assembly in the trunk. The rear amplifier operates in the same manner as the one used in front unit.

e. Transducer

The transducer for the rear assembly is mounted on the rear face of the case assembly just to the left of the amplifier.

f. Power Servo

The power servo is mounted on the left vertical surface of the case assembly.

Suction Throttling Valve (Fig. 1-9) (697 Rear)

The pilot operated absolute suction throttling valve is located on the left front side of the evaporator assembly, in the low pressure line to the compressor. The valve body contains two ports; the evaporator gage port on the inlet side of the valve, and a port on the outlet side for the external equalizer line.

This valve works in the same manner as that used on front systems, but is calibrated to control the rear evaporator pressure to 27 psi.

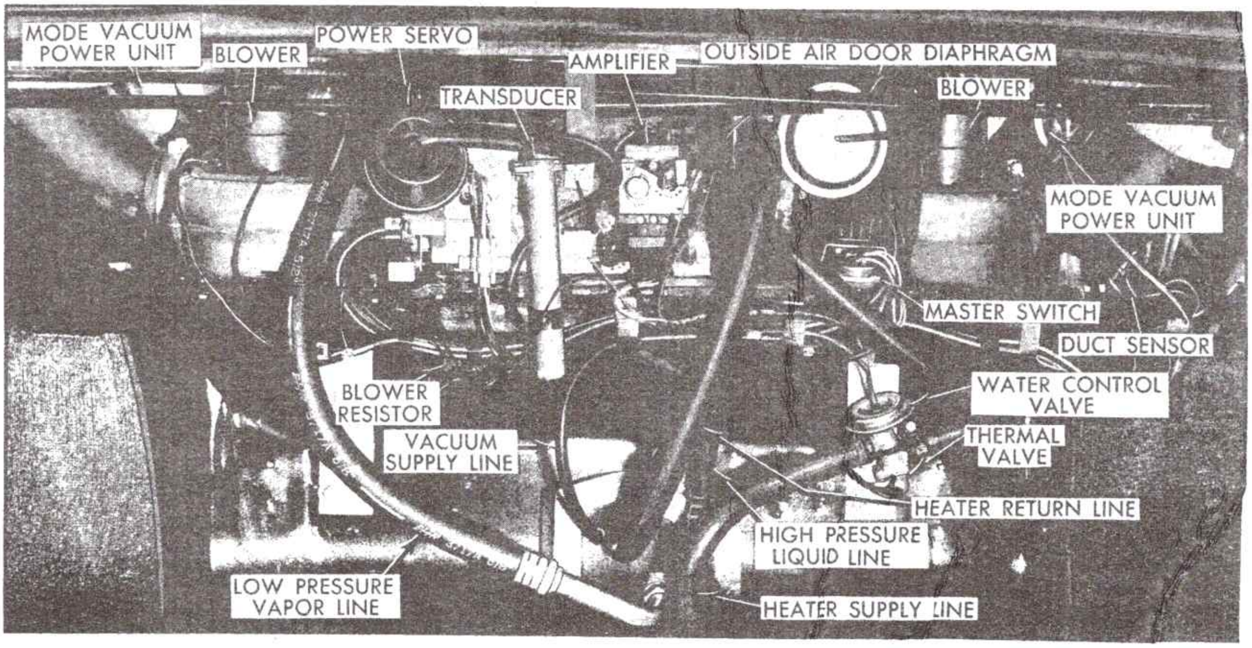


Fig. 1-72 Rear Unit Components on Car

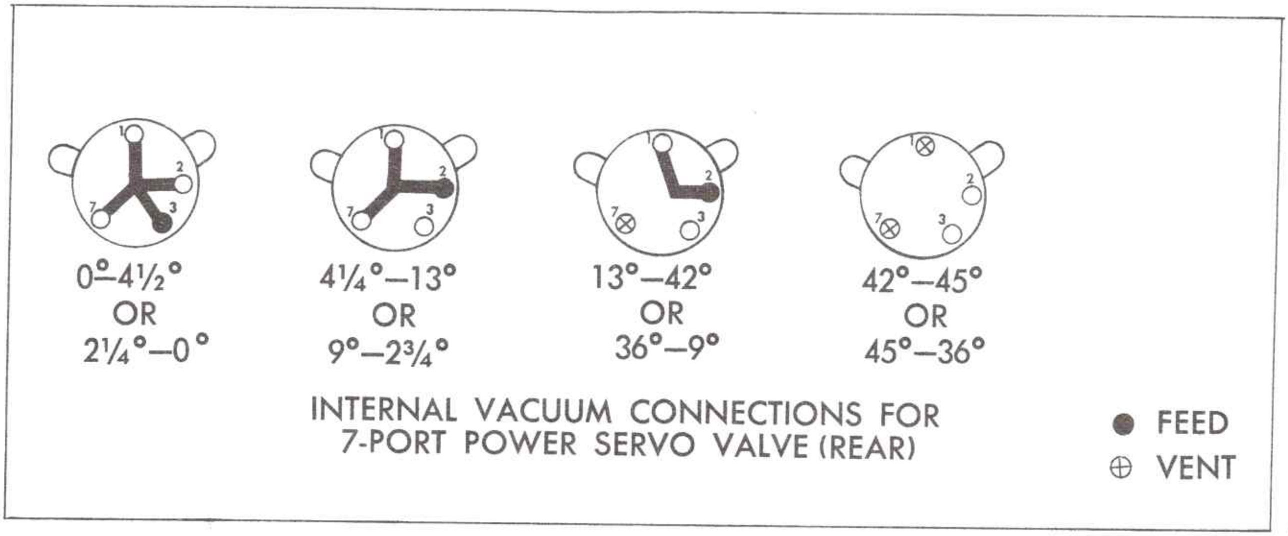


Fig. 1-73 Rear Rotary Vacuum Valve Internal Connections

Expansion Valve (697 Rear)

An expansion valve is used in the rear system to perform the same function as the valve used in the front system. The rear expansion valve is contained within the evaporator case on the lower left front side.

Evaporator (697 Rear)

The evaporator used on the rear system is smaller and of different construction than that used in front systems. The rear evaporator is located in the case assembly in the luggage compartment under the package shelf.

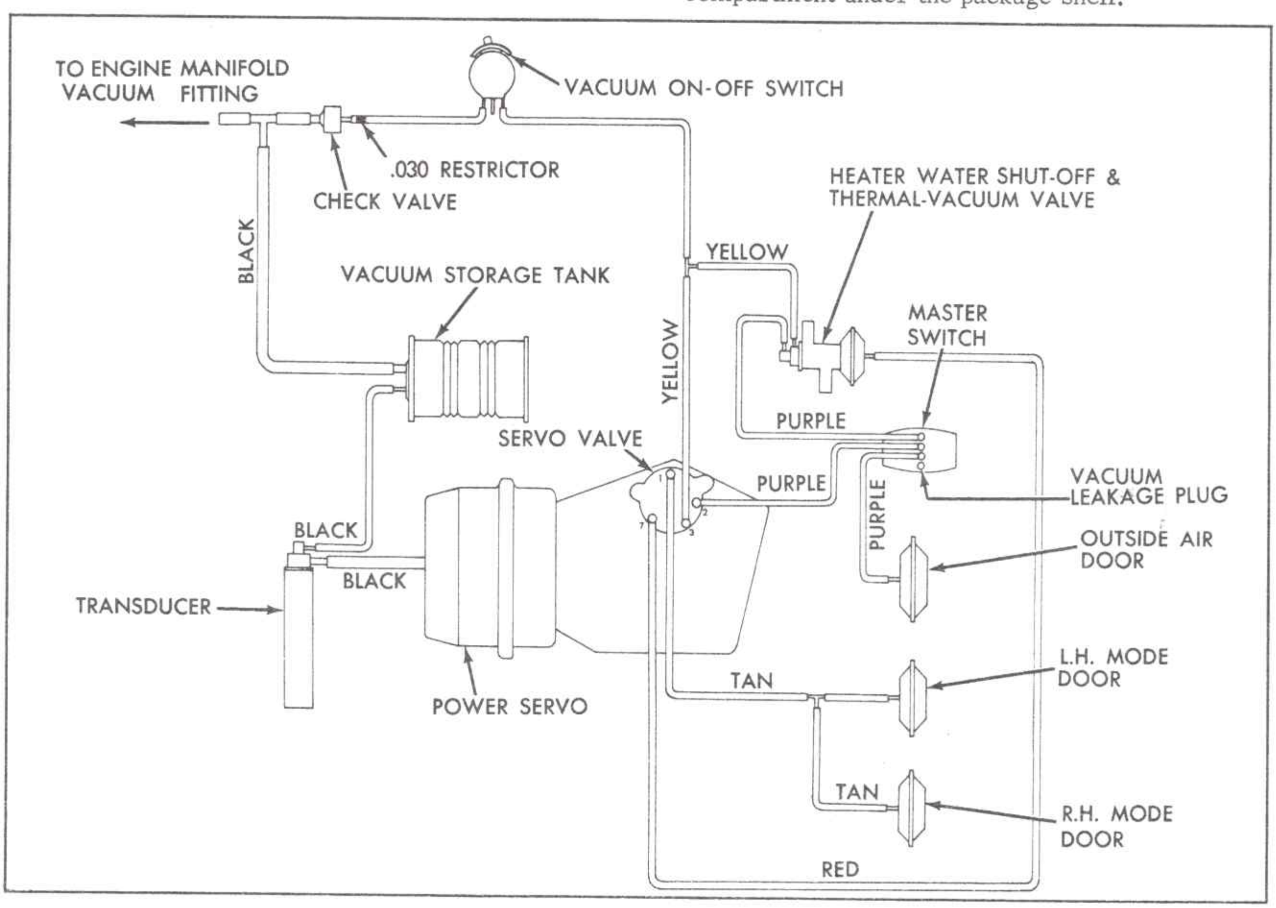


Fig. 1-74 Automatic Climate Control Vacuum Schematic (Rear Unit)

Blower Assemblies (697 Rear)

Two blower assemblies are used on the rear system. Air from the heater air conditioner assembly is drawn into blower assemblies on either side of the case and then expelled into the car.

Control Panel (697 Rear)

The control panel, located in the right rear arm rest, consists of a temperature dial and an ON-OFF switch. The temperature dial is graduated in 5 degree divisions from 65°F to 85°F. This dial is used to select the desired temperature. The ON-OFF switch controls vacuum feed to the rear system and is used to turn the system On or Off.

Vacuum Circuit

The Automatic Climate Control system incorporates two basic vacuum circuits. The first circuit controls the position of the power servo unit, and the second circuit controls the operation of the various vacuum operated components of the system.

Vacuum flows from the engine through the vacuum storage tank to the transducer. The vacuum, now regulated by the transducer, then flows to the power servo unit.

The second vacuum circuit flows from the engine through the check valve to the On-Off switch and from there to the servo vacuum valve. To trace the path of the vacuum, refer to the servo valve connections, Fig. 1-73 and to Fig. 1-74. The restrictor provides a time delay to allow the power servo unit to position itself before vacuum is supplied to the rotary vacuum valve.

Operation

a. Off

NOTE: For the purpose of this discussion, assume the control switch is in the OFF position, and the engine is running.

Whenever the engine is operating, the sensor string is transmitting a signal to the amplifier. The signal is converted to a proportionate DC voltage by the amplifier, and is fed to the transducer. The transducer converts the electrical signal to a proportionate regulated vacuum output that is supplied to the vacuum power unit of the power servo, thus placing the power servo unit in the proper operating position, if the system were to be started.

b. Maximum Cooling

NOTE: For the purpose of this discussion; assume the ambient air temperature is 90°F, the in-car temperature is 90°F, the temperature dial rheostat is set at 75°F, and the engine is running.

Due to the high temperatures acting on the sensors, the resistance values of the sensors will be low, causing a strong signal to the amplifier. The output of the amplifier is high, and is being fed to the transducer, where it is converted to a weak vacuum output, causing the power servo to be in the maximum air conditioning position.

When the switch is placed in the "ON" position, vacuum is fed to the master switch, completing the electrical circuit to the blower motor and compressor, and to the servo vacuum valve. In the maximum air conditioning position, the servo valve performs the following vacuum functions:

The mode doors are moved to the air conditioning position, allowing the discharge air to be discharged through the air conditioner outlets. The water control valve is closed, preventing the flow of engine coolant to the heater core.

In addition, the power servo has placed the temperature door in the maximum cooling position, preventing any air flow through the heater core. The blower is operating at HIGH speed. Because of its connection at the master switch, the outside air door is opened, admitting outside air into the system.

As the system operates the in-car and duct sensors, sensing the lowering temperatures, increase in resistance, causing more vacuum to be fed to the power servo unit. The power servo then performs the necessary events, in the proper sequence, Fig. 1-75, until such time as the system reaches a balanced position to hold the interior temperature to the dial setting.

Power Servo Arm Angle		Event
Increasing Vacuum	Decreasing Vacuum	
4-1/4°	2-3/4°	A/C Over Ride Begin - End
13°	9°	Water Control Valve Close - Open
42°	36°	Change Model A/C - Heat

Fig. 1-75 Sequence of Events (Rear Unit)

As the vacuum supplied to the power servo vacuum power unit increases, the position of the operating arm and the servo vacuum valve changes. The blower decreases to M2 speed. Vacuum to the hot water valve is cut off, causing the hot water valve to pass engine coolant.

As the system continues to modulate, the blower will decrease to M1 speed and then the position of the temperature door will change to allow the entry of heated air that will mix with the cooled air. Continued modulation by the system can decrease the blower to LOW speed. The system will modulate itself to maintain the interior temperature, regardless of any change in the ambient air temperature.

If the ambient air temperature were to fall quite rapidly, the ambient sensor resistance value would increase, causing a weaker voltage signal to be sent to the transducer. The power servo unit would move towards the heater position as the vacuum output from the transducer was increased. The system would switch into the heater mode and the blower speed would increase to M1, then M2, and HIGH. During the increase of blower speeds, the temperature door would be traveling toward the maximum heat position and eventually would prevent all cold air from entering the system.

c. Maximum Heat

NOTE: For the purpose of this discussion, assume the ambient air temperature is 0°F, the in-car temperature is 0°F, the temperature dial is set at 75°F, and the engine is running.

Due to the low temperatures acting on the sensors, their resistance values will be high, causing a weak signal to the amplifier. The output of the amplifier is low, and is being fed to the transducer, where it is converted to a strong vacuum output causing the power servo to move toward the maximum heat position.

When the switch is placed in the ON position, the restrictor in the vacuum line, Fig. 1-74, prevents vacuum from reaching the servo vacuum valve until the power servo has reached the heat mode. In the heat mode, the vacuum circuitry is such that the vacuum must pass through the thermal vacuum valve in order to actuate the master switch. The compressor clutch circuit is held open by the ambient switch in the front unit any time it is below 32°F.

Once the engine coolant has reached the temperature of approximately 140°F, vacuum flows through the thermal vacuum valve, causing the outside air door to open and the blower to operate at HIGH speed, admitting heated air into the car. The in-car and duct sensors sense the temperature rise and, as their resistance values lower, the system begins to modulate and the blower speeds will diminish to M2, M1 and then to LOW. During the decrease in blower speeds, the temperature door would travel from the maximum heat position to a mid-position, blending heated and cooled air. If the outside air temperature were to rise to about 35°F, the compressor clutch circuit would close, causing compressor operation to begin. Continued temperature increases, sensed by the sensors, cause the system to move toward the air conditioning position.

Electrical Circuit (Fig. 1-76)

The Automatic Climate Control electrical circuit flows from the accessory terminal of the ignition switch to the 25 ampere fuse in the fuse block, and then to the amplifier, to the ambient sensor, and to the master switch.

The master switch sends current through the diode assembly, mounted on the dash board, to energize the compressor clutch when the front unit ambient switch is closed. A compressor diode assembly is incorporated into the compressor circuit of the front and rear units on the Fleetwood Seventy-Five systems. The compressor diode assembly permits the master switch of either unit to supply current to the compressor clutch without causing a feed back into the other system. A feed back from one system into the other would cause the master switch of that unit to be overridden and the system's blower to operate even though the system was turned off. The compressor diode assembly is mounted on an instrument panel molding stud to the right of the radio in the dash panel.

The sensor string circuit current flows from the ambient sensor to the discharge air sensor, to the in-car sensor, and then to the amplifier.

58. Adjustments (697 Rear)

a. Temperature Door Link

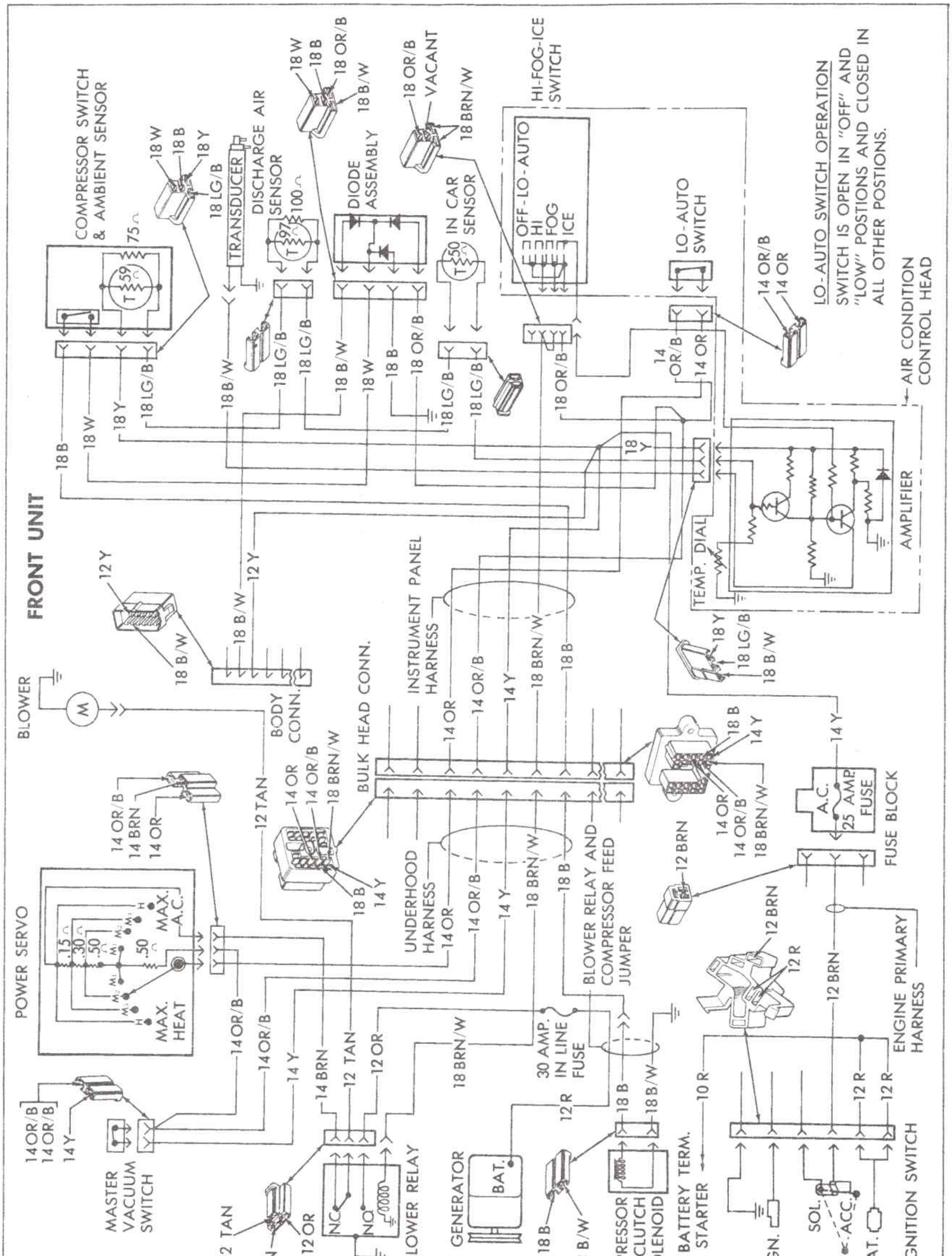
1. Loosen temperature door adjusting link screw.

2. Apply vacuum to power servo vacuum power unit.

3. Tighten temperature door adjusting link until head of screw contacts link then continue to tighten just enough to take play out of link.

b. Temperature Dial

NOTE: If system is working properly, perform temperature dial test as described in Notes 61a, step 6, 61b step 7, or 61c.


FRONT UNIT
COMPRESSOR SWITCH & AMBIENT SENSOR
TRANSDUCER
DISCHARGE AIR SENSOR
DIODE ASSEMBLY
IN CAR SENSOR
HI-FOG-ICE SWITCH
OFF-LO-AUTO
HI
FOG
ICE
LO-AUTO SWITCH
LO-AUTO SWITCH OPERATION
SWITCH IS OPEN IN "OFF" AND "LOW" POSITIONS AND CLOSED IN ALL OTHER POSITIONS.
AIR CONDITION CONTROL HEAD
AMPLIFIER
TEMP. DIAL
INSTRUMENT PANEL HARNESS
BULK HEAD CONN.
BODY CONN.
BLOWER
POWER SERVO
MAX. HEAT
MAX. A.C.
UNDERHOOD HARNESS
BLOWER RELAY AND COMPRESSOR FEED JUMPER
30 AMP. IN LINE FUSE
A.C. 25 AMP. FUSE
FUSE BLOCK
ENGINE PRIMARY HARNESS
MASTER VACUUM SWITCH
BLOWER RELAY
GENERATOR
BAT.
COMPRESSOR CLUTCH SOLENOID
TO BATTERY TERM. ON STARTER
IGNITION SWITCH
IGN.
SOL.
ACC.
BAT.
VACANT

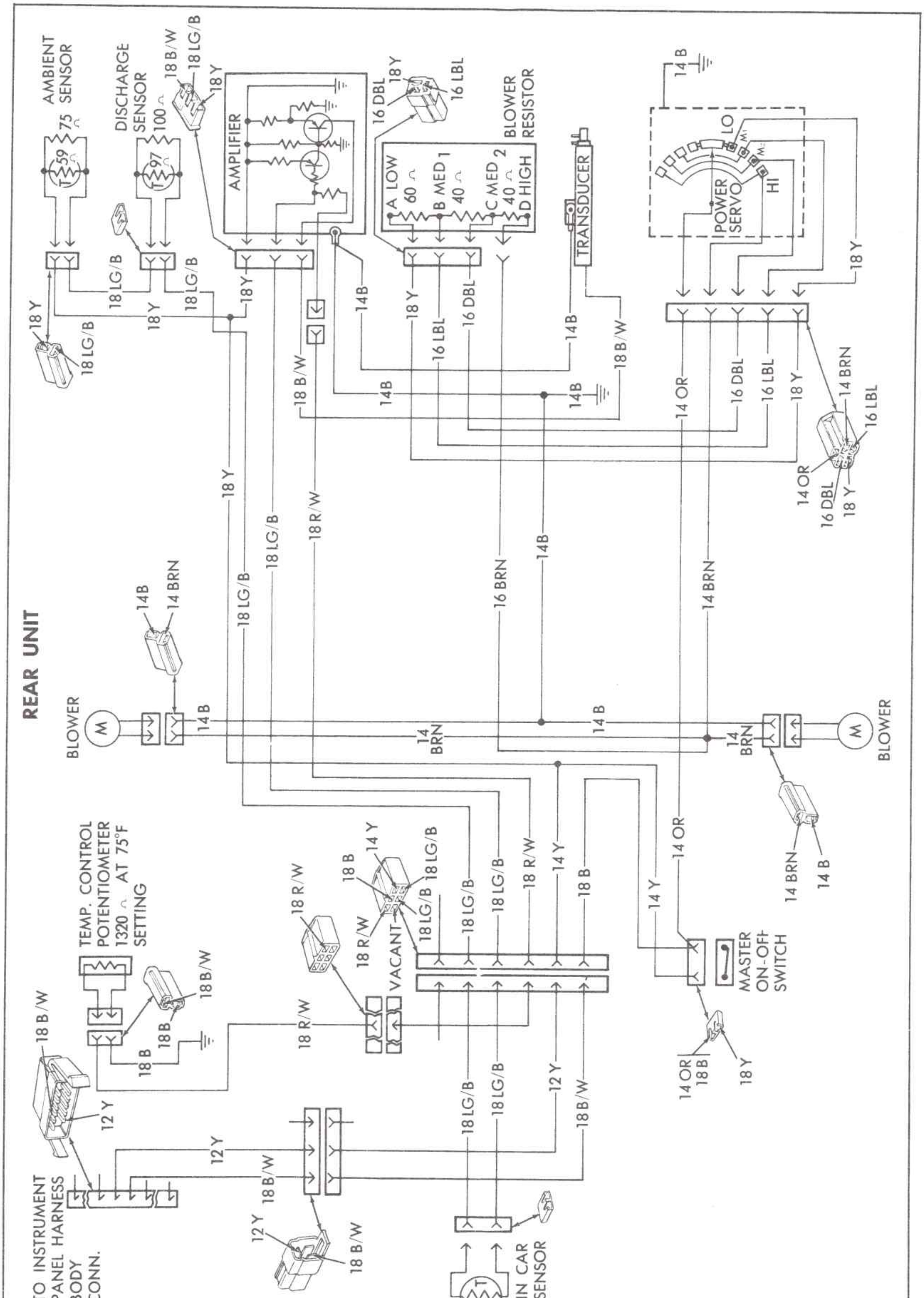


Fig. 1-76 Automatic Climate Control Electrical Circuit (697)

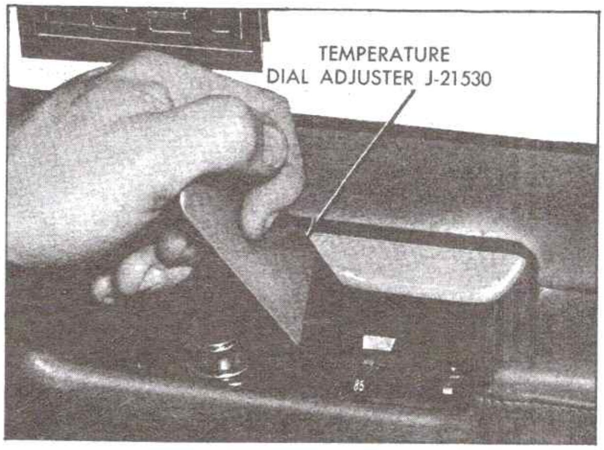


Fig. 1-77 Adjusting Rear Temperature Dial (697)

Although the temperature dial may be operating correctly, it may be necessary to change the temperature dial setting for customer satisfaction. If an owner indicates a particular temperature dial setting where he is most comfortable, set temperature dial to that setting and proceed as follows:

1. Insert Temperature Dial Adjuster, J-21530, between temperature dial and casting, Fig. 1-77.

2. Turn dial to proper setting as determined by test procedure used.

59. Performance Test (697 Only)

To determine the efficiency of the Fleetwood Seventy-Five Air Conditioning system, run a performance test as outlined below:

1. Place transmission in PARK and start engine.

2. Check operation of controls by rotating temperature dials from stop to stop.

3. Turn off engine.

4. Purge high and low pressure lines on Charging Station J-8393.

5. Connect Charging Station high pressure line to high pressure fitting on compressor, and low pressure line to evaporator gage fitting on suction throttling valve.

6. Disconnect vacuum hoses from both power servo vacuum power units and plug hoses.

7. Close hood as far as possible without pinching lines. Use masking tape to cover gap at rear of hood.

8. Place auxiliary fan (approximately 24 inch dia. blades) thirty inches from front bumper and direct air stream to center of radiator grille.

NOTE: Volume must be sufficient to obtain proper head and return pressures.

9. Place thermometer in air stream between auxiliary fan and radiator grille. Thermometer bulb must not contact any metal.

10. Place another thermometer in right front air conditioning outlet grille. Thermometer bulb must not contact any metal.

11. Open all doors and windows.

12. Use Humidicator, J-6076, to obtain simultaneous temperature and relative humidity readings of air entering air intake grille as follows:

a. Shake thermometer down to settle red and blue columns in bottom of tubes.

b. Thoroughly moisten wick on blue thermometer with water.

c. Place humidicator on right hand side of cowl air intake grille so that entering air passes over bulbs of thermometer.

13. Place thermometer in right rear roof outlet and open deflector doors.

14. Place another thermometer on center of package shelf over return air intake.

15. Turn on auxiliary fan.

16. With transmission in PARK start engine and operate at 2,000 rpm.

17. After five minutes, record:

a. Humidicator red and blue bulb readings. (Red bulb reading is temperature of air entering air intake grille.)

b. Temperature of air being discharged through right front air conditioning outlet.

c. Temperature of air entering grille.

d. Head pressure

e. Front evaporator pressure.

f. Temperature of air being discharged from right rear outlet.

g. Temperature of air returning to rear evaporator assembly.

18. Turn off engine and auxiliary fan.

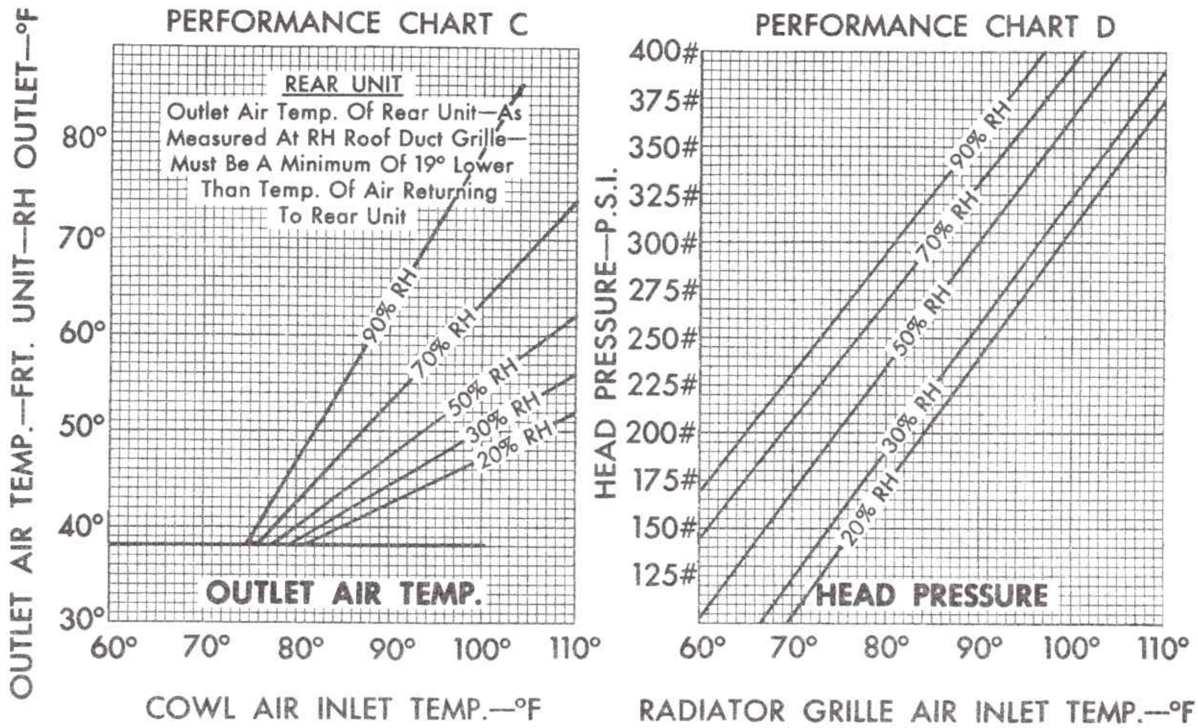


Fig. 1-78 Air Conditioning Performance Chart (697)

19. To determine relative humidity of air entering air intake grille, position inner scale of humidicator so that blue (wet bulb) temperature is opposite red (dry bulb) temperature. Relative humidity is indicated by humidity arrow. Record relative humidity.

20. Refer to Chart C, Fig. 1-78 to determine if outlet air temperatures are normal. If outlet temperatures are the same or below reading on chart, operation is normal.

21. Refer to Chart D, Fig. 1-78 to determine if head pressure is normal. If head pressure is within 30 pounds below reading on chart, operation is normal.

22. Disconnect Charging Station.

23. Install vacuum hose on power servo vacuum power units after unplugging.

60. Connecting Automatic Climate Control Tester

The Automatic Climate Control Tester, J-21512, and the Automatic Temperature Control Tester, J-22368-01, are used to isolate an electrical malfunction in the Automatic Climate Control system by serving as a substitute for components of the system. To use:

1. Remove trim panel inside luggage compartment.

2. Disconnect three-way connector from the amplifier.

3. Connect three-way electrical connector of tester -- the one with three female terminals -- to amplifier terminal.

4. Connect second multiple connector of tester to car wiring harness.

5. Connect ground lead to car body.

6. When using J-22368-01, disconnect large vacuum hose at transducer and insert tester tee in vacuum line.

61. Testing Automatic Climate Control System

Two testers are avilable to perform these tests. Due to differences between the testers, two procedures are given in this note. Follow the test procedure that applies to the tester to be used.

a. Automatic Climate Control Tester, J-21512

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system, when the system turns ON, but operates only in maximum heat or maximum air conditioner at high blower speed. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 6. If system still performs incorrectly, proceed as follows:

NOTE: For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.

1. Preliminary Test

a. Place transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in steps b and c, proceed to step 2.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 5.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

2. Sensor String Test

a. Turn engine off if still operating, and connect Automatic Climate Control Tester, J-21512, as described in Note 60.

b. Set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position.

e. Place Sensor switch to A/C position. System and tester meter should go to full air conditioning.

f. Place Sensor switch in HTR position. System and tester meter should go to full heater.

g. If system did not perform correctly in steps e and f, proceed to step 3.

h. If system performed correctly, disconnect Automatic Climate Control Tester and reconnect car wiring harness. Visually inspect in-car sensor, replace if apparently defective, and check operation of system.

i. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

j. If an ohmmeter is available, measure resistance value of ambient sensor, duct sensor and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-24. Replace any defective sensor located. If no defective sensor is found, check car wiring.

k. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

3. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place Amplifier switch on Automatic Climate Tester, J-21512, in AMPLIFIER position.

b. Turn Amplifier Control counterclockwise to stop. System and tester meter should go to full air conditioning.

c. Turn Amplifier Control clockwise to stop. System and tester meter should go to full heater.

NOTE: If tester meter does not vary with variation in Amplifier Control, transducer, or electrical circuit to transducer, is defective.

d. If steps b and c do not result in correct system operation, proceed to step 4.

e. If system operated properly in steps b and c, disconnect Automatic Climate Control Tester and reconnect car wiring harness to amplifier.

f. Disconnect red wire from temperature dial rheostat terminal on amplifier. With wire open, system should go to full air conditioning.

g. Ground red wire. System should go to full heat.

h. If system performed properly in steps f and g. replace temperature dial rheostat.

i. If system failed to perform properly in steps f and g, replace amplifier circuit board.

j. If system fails to work properly after replacing amplifier circuit board, check car wiring.

4. Regulated Vacuum Test

NOTE: Automatic Climate Control Tester, J-21512, should still be plugged in and engine should be running.

a. Connect a vacuum gage to transducer vacuum input hose. Gage should read above 14 inch Hg. If not, locate and correct vacuum failure.

b. Reconnect vacuum input hose and connect vacuum gage to transducer output fitting, using a length of vacuum hose.

c. Make certain that temperature dial is at 71° setting.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position. Turn sensor switch to MID position and rotate temperature dial until tester meter needle reads on set line. Vacuum gage should read between 3.5 inch Hg. and 7.2 inch Hg. If not, replace transducer.

e. Rotate temperature dial to 65° setting vacuum gage should read 1.5 inch Hg. or less. If vacuum reading is higher, turn Sensor switch to A/C position, gage should now read 1.5 inch Hg. or less. If not, replace transducer.

f. Repeat step d.

g. Rotate temperature dial to 85° setting, vacuum gage should read 10 inch Hg. or more. If vacuum reading is lower, turn Sensor switch to HTR position, gage should now read 10 inch Hg. or more. If not, replace transducer. Check car wiring.

h. Rotate temperature dial to 71° setting and place Amplifier switch in AMPLIFIER position. Rotate tester Amplifier control from stop to stop. Output of transducer should vary between 1.5 inch Hg. or less, to 10 inch Hg. or more within 10 seconds. If not, replace transducer.

5. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 71° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.

d. Rotate temperature dial back to 71° setting. Vacuum reading should always be above 14 inch Hg., except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Figs. 1-73 and 1-74, determine what valves, hoses and vacuum power units are involved to locate leak.

6. Temperature Dial Test with Automatic Climate Control Tester, J-21512.

NOTE: This test can be made only when the system is operating properly.

a. Place Amplifier switch in SENSOR position.

b. Place Sensor switch in MID position.

c. Adjust temperature dial until tester meter reads on SET line. Temperature dial should read 71°.

d. If temperature dial does not read 71°, adjust dial as described in Note 58b.

7. Shut off engine and remove Automatic Climate Control Tester from system and connect car wiring harness to amplifier connector.

8. Intermittent Conditions

a. Connect the positive lead of an accurate voltmeter to the transducer wire at the transducer connector. Ground the negative lead to the car body.

b. Allow system to operate and stabilize.

c. Tap the sensors, temperature dial and amplifier. A severe rap is necessary. Jiggle wires to the various units.

d. Watch the voltmeter for any sharp variation in the meter reading. Note the operation of the system.

e. If a variation occurs when a unit is tapped, check that unit for weak connections. Repair connections as necessary.

b. Automatic Temperature Control Tester, J-22368-01

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 7. If system still performs incorrectly, proceed with listed tests.

For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.

1. Preliminary Test

a. Place Transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in steps b and c, proceed to step 3.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 6.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

h. If system failed to turn on, proceed to step 2.

2. Source Test

a. Turn off engine if still operating and connect Automatic Temperature Control Tester, J-22368-01, as described in Note 60.

b. Turn system ON and set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place rocker switch on Automatic Temperature Control Tester, J-22368-01 in MANUAL position.

e. Turn voltage knob to SOURCE position.

f. Set manual control knob to 150 position.

g. Tester meter should read battery voltage.

h. If meter does not read battery voltage, check the power supply wires for shorts, grounds or opens. Check for blown fuse. The tester may be used for checking the wiring by turning the voltage knob to the PROBE position and using the red probe.

i. If meter read battery voltage in step g, proceed to step 3.

3. Sensor String Test (Opens)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to SENSOR position.

c. Set manual control knob to 150 position.

d. Tester meter should read battery voltage.

e. If meter read battery voltage in step d, proceed to step 4.

f. If meter did not read battery voltage in step d, visually inspect in-car sensor, replace if apparently defective, and check operation of system.

g. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

h. If an ohmmeter is available, measure resistance value of ambient sensor, duct sensor and then in-car sensor. Sensor resistance value should approximate resistance value given in

Fig. 1-24. Replace any defective sensor located. If no defective sensor is found, check car wiring.

i. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

4. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Turn manual control to MAX. HEAT position.

d. Meter should read from 0 to 4 volts.

e. Turn manual control to MAX. COLD position.

f. Meter should read 8 volts minimum.

g. If steps c through f do not result in correct readings, proceed to step i.

h. If proper readings were achieved in steps c through f, proceed to step 5.

i. Disconnect red wire from temperature dial rheostat terminal. With wire open, system should go to full air conditioning. Meter should read 8 volts minimum.

j. Ground red wire. System should go to full heat, meter should read 0-4 volts.

k. If system performed properly in steps i and j, replace temperature dial rheostat.

l. If system failed to perform properly in steps i and j, replace amplifier circuit board.

m. If system fails to work properly after replacing amplifier circuit board, check car wiring.

5. Transducer Test

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to TRANSDUCER position.

c. Turn manual control to MAX. COLD position.

d. Tester meter should read 8 volts minimum and vacuum gage should read 0-3 inches vacuum. Maximum blower should be achieved.

e. Turn manual control to MAX. HEAT position.

f. Tester meter should read 0-4 volts and vacuum gage should read 9 inches minimum vacuum. Maximum blower should be achieved.

g. If proper readings are not obtained in steps c through f, check wiring to transducer circuit for shorts, grounds or opens. Check for improperly grounded transducer. Replace transducer.

6. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 71° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.

d. Rotate temperature dial back to 71° setting. Vacuum reading should always be above 14 inch Hg., except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Figs. 1-73 and 1-74, determine what valves, hoses and vacuum power units are involved to locate leak.

7. Temperature Dial Test with Automatic Temperature Control Tester, J-22368-01.

a. Place rocker switch in MANUAL position.

b. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Set manual control to 138 position.

d. Rotate temperature dial until tester meter indicates 6.5 volts.

e. Temperature dial should indicate 75°F.

f. If temperature dial does not indicate proper setting, adjust temperature dial as indicated in Note 58b.

8. Operational Test (697 ONLY)

a. This procedure is to be used when testing either system on the Fleetwood Seventy-Five. The tester should be connected to the system to be tested as described in Note 15 for front system or Note 60 for rear system. Both systems should be turned ON, the front system should be operating in AUTO. The temperature dials should be set at 75°.

b. Position rocker switch in AUTOMATIC position.

c. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

d. Set manual control to 150 position.

e. Allow five minutes for systems to stabilize with doors and windows closed.

f. Meter should read 5.5 - 7.5 volts.

g. If improper reading is obtained in step f, check for shorted sensor.

h. If proper reading is achieved in step f, tap sensors and amplifier.

i. If meter needle jumps when a unit is tapped, check that unit for weak connections that will cause an intermittent defect in system.

j. If proper reading is achieved in step f, with no movement of the needle in step i and all steps in Note 16b, steps 1-7 for front units or Note 61b, steps 1-7 for rear units have been completed, system is operating properly.

k. Shut off engine and remove Automatic Temperature Control Tester, J-22368-01 from system. Connect car wiring harness connector to amplifier connector and large vacuum hose to transducer. Install any trim items removed.

c. Temperature Dial Operational Test

NOTE: This test is performed without the Automatic Temperature Control Tester, J-22368-01, or Automatic Climate Control Tester, J-21512. Although it is less efficient it allows for the tailoring of a system to meet the requirements of an individual owner.

a. Using masking tape, suspend a thermometer from headliner so that bulb hangs at breath level over front passenger's seat.

b. Suspend a second thermometer at breath level midway between the rear roof outlets.

c. Position auxiliary fan (approximately 24 inch dia. blades) so that air stream is directed across air intake grille.

d. Close all doors and windows.

e. Set both temperature dials to 75°.

f. With shift lever in PARK position, start engine and operate at 900 rpm.

g. Making certain that all air conditioner outlets are open, adjust as follows:

1. Front end outlets so that air is directed toward doors.

2. Front center outlet so air is directed toward top of front seat.

3. Rear roof outlet diverter doors should be opened.

CAUTION: Outlet air must not be directed toward thermometers.

h. Allow systems to operate for 25 minutes for stabilization, then record reading from suspended thermometers.

i. If thermometers vary from 75° setting, adjust temperature dials to coincide with nearest thermometer reading, as indicated in Note 13b front, and Note 58b, rear.

62. Automatic Climate Control Panel (697 Rear)

a. Removal

1. Remove back seat cushion.

2. Pull down on center arm rest and remove two fabric retaining screws and two cap screws securing seat back to body braces.

3. Straighten retaining clips along bottom of seat back.

4. Pull out on bottom of seat back, lift seat back up and off top retaining brackets, and remove seat back.

5. Remove right seat back filler panel.

6. Remove right rear quarter window moldings.

7. Remove three screws at bottom of arm rest.

8. Remove power window switches and remove screw holding trim panel in place.

9. Remove trim panel and arm rest assembly.

b. Installation

1. Replace trim panel and arm rest assembly.

2. Secure trim panel with one screw and install power window switch.

3. Replace three screws at bottom of arm rest assembly.

4. Install right rear quarter window moldings.

5. Install seat back filler panel.

6. Position seat back to engage top retaining brackets and bend retaining clips over hooks along bottom of seat back.

7. Secure seat back to body brackets with two cap screws in area of center arm rest and replace arm rest fabric. Secure fabric with two screws.

8. Install back seat cushion.

63. Air Conditioner Control Panel Disassembly and Assembly

a. Temperature Dial Rheostat Removal

1. Remove control panel as described in Note 62a.

2. Disconnect electrical connector inside arm rest.

3. Remove two screws securing rheostat to control panel and remove rheostat.

b. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and secure with two screws.

2. Connect electrical connector.

3. Install control panel as described in Note 62b.

4. Adjust temperature dial as described in Note 58b.

c. Control Switch Removal

1. Remove control panel as described in Note 62a.

2. Disconnect black and yellow hoses from control switch.

3. Remove two screws and remove switch.

d. Control Switch Installation

1. Position switch to control panel and secure with two screws.

2. Connect black and yellow hoses to ports as indicated by color coding dots on switch assembly.

3. Install control panel as described in Note 62b.

64. Amplifier (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.

2. Remove multiple connector from amplifier terminals.

3. Disconnect red wire at single connector.

4. Remove spring clip securing multiple connector to mounting plate.

5. Remove screw securing amplifier circuit board to mounting plate.

b. Installation

1. Position amplifier circuit board to mounting plate and install screw securing circuit board to mounting plate.

2. Install spring clip securing multiple connector to mounting plate.

3. Connect red wire at single connector.

4. Connect multiple connector to amplifier terminals.

5. Install trim panel inside luggage compartment.

65. In-Car Sensor (697 Rear)

a. Removal

1. Snap protective grille off in-car sensor on package shelf inside car.

2. Remove two screws securing sensor to package shelf.

3. Disconnect in-car sensor from electrical connector.

4. Carefully remove in-car sensor.

b. Installation

1. Connect in-car sensor to electrical connector.

2. Position in-car sensor on package shelf.

3. Secure in-car sensor to package shelf with two screws.

4. Snap protective grille over in-car sensor on package shelf.

66. Ambient Sensor (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.

2. Disconnect electrical connector.

3. Disconnect ambient air hose from right air scoop.

4. Remove four nuts securing air scoop to body.

5. Lift air scoop from car body and remove rubber gasket from bottom of air scoop.

6. Remove two screws securing grille to air scoop and remove grille.

7. Remove two screws securing ambient sensor to air scoop and remove sensor.

b. Installation

1. Position sensor to air scoop and secure with two screws.

2. Secure grille to air scoop with two screws and position gasket on bottom of air scoop.

3. Position air scoop on body and secure with four nuts.

4. Connect electrical connector.

5. Connect ambient air hose to air scoop.

6. Replace trim panel in luggage compartment.

67. Duct Sensor (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.

2. Disconnect electrical connector from sensor terminals.

3. Remove two screws securing sensor to right mode door assembly and remove sensor.

b. Installation

1. Position sensor to right mode door assembly and secure with two screws.

2. Connect electrical connector to sensor terminals.

3. Install trim panel inside luggage compartment.

68. Water Control Valve (697 Rear)

NOTE: The water control valve and thermal vacuum valve are serviced as an assembly. Front and rear water control valves are not interchangeable. Rear valves may be identified by a RED ring on vacuum actuator.

a. Removal

1. Remove trim panel inside luggage compartment.

2. Pinch off valve inlet and outlet water hoses.

3. Position shallow pan under water control valve to catch any coolant that may spill.

4. Remove clamps securing hoses to valve, and remove water hoses.

5. Remove vacuum hoses from thermal vacuum valve, and remove vacuum hose from water control valve vacuum power unit.

6. Remove horseshoe spring retainer clip securing valve to mounting bracket and remove valve.

b. Installation

1. Position water control valve to mounting bracket and secure with horseshoe spring retainer clip.

2. Install water hoses on valve inlet and outlet fittings and install clamps on hoses.

3. Remove clamps pinching off hoses.

4. Install vacuum hoses on thermal vacuum valve.

NOTE: Yellow stripped hose connects to vacuum nipple closest to water outlet fitting.

5. Connect red stripped vacuum hose to water control valve vacuum power unit.

6. Install trim panel inside luggage compartment.

7. Replace any coolant lost.

69. Blower Resistor (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.

2. Remove multiple connector from blower resistor.

3. Remove single connector from blower resistor.

4. Remove two screws securing blower resistor to bottom of case assembly.

5. Remove blower resistor from bottom of case assembly.

b. Installation

1. Position blower resistor into bottom of case assembly.

2. Secure resistor to case assembly with two screws.

3. Install single connector on blower resistor.

4. Install multiple connector on blower resistor.

5. Install trim panel inside luggage compartment.

70. Blower Motor Assemblies (697 Rear)

This procedure applies to both right and left blower motors.

a. Removal

1. Remove trim panel inside luggage compartment.

2. Disconnect double connector at motor to be removed. Connector is located in front of motor.

3. Pull back rubber material from screw heads and remove five screws securing blower motor to blower housing.

4. Remove blower and fan assembly.

b. Installation

1. Position blower motor and fan assembly in blower housing and secure with five screws, and replace rubber insulating material.

2. Connect double connector.

3. Install trim panel inside luggage compartment.

71. Master Switch (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.

2. Disconnect vacuum hoses from master switch.

3. Disconnect electrical connector from master switch.

4. Remove screw securing master switch mounting bracket to case and remove master switch and mounting bracket.

5. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.

2. Position master switch mounting bracket to case and install screw securing mounting bracket to case.

3. Connect electrical connector to master switch.

4. Install vacuum hoses to master switch.

5. Install trim panel inside luggage compartment.

72. Power Servo (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.

2. Disconnect multiple electrical connector from power servo.

3. Disconnect multiple vacuum connector from servo valve.

4. Disconnect vacuum hose from power servo vacuum power unit.

5. Disconnect temperature door link at temperature door arm.

6. Remove two screws securing power servo to case.

7. Remove power servo.

b. Installation

1. Position power servo into opening in case and secure with two screws.

2. Connect vacuum hose to power servo vacuum power unit.

3. Connect multiple vacuum connector to servo valve.

4. Connect multiple electrical connector.

5. Connect temperature door link and adjust as described in Note 58a.

6. Replace trim panel inside luggage compartment.

73. Power Servo Vacuum Valve (697 Rear)

a. Removal

1. Disconnect multiple hose connector.

2. Remove spring clip and one screw securing vacuum valve to power servo.

3. Remove vacuum valve.

b. Installation

1. Position vacuum valve on power servo and secure with one screw and spring clip.

2. Connect multiple hose connector.

74. Mode Door Assemblies

This procedure applies to both right and left mode door assemblies.

a. Removal

1. Remove trim panel inside luggage compartment.

2. Remove duct sensor electrical connector from right mode door assembly only.

3. Remove vacuum hose from mode door vacuum diaphragm.

4. Loosen clamps securing mode door assembly to blower assembly, heater discharge and air conditioner discharge hoses.

5. Slide discharge hoses off of mode door assembly and lift assembly off of blower outlets.

b. Installation

1. Install mode door vacuum hose on diaphragm.

2. Position mode door assembly on blower outlet.

3. Position heater discharge and air conditioner discharge hoses on mode door assembly.

4. Secure mode door assembly on blower assembly by tightening clamp.

5. Secure heater discharge and air conditioner discharge hoses onto mode door assembly by tightening clamps.

6. Install duct sensor electrical connector into right mode door assembly only.

7. Install trim panel inside luggage compartment.

75. Transducer (697 Rear)

CAUTION: The transducer should be handled with great care as its calibration can be destroyed by a sharp bump.

a. Removal

1. Remove trim panel inside luggage compartment.

2. Disconnect vacuum hoses from fittings on transducer.

3. Disconnect transducer electrical connector.

4. Remove screw and lockwasher securing transducer mounting bracket to evaporator case and remove transducer.

b. Installation

1. Position transducer mounting bracket to case and secure with lockwasher and screw.

2. Connect transducer electrical connector.

3. Connect vacuum hoses to fittings on transducer.

NOTE: Vacuum hose with smallest I.D. goes on top fitting of transducer.

4. Replace trim panel inside luggage compartment.

76. Compressor Diode Assembly (697 Only)

The procedure for removing and installing the compressor diode assembly is described in Section 12, Note 63.

77. Blower Evaporator Assembly

a. Removal

1. Remove trim panel inside luggage compartment.

2. Purge system as described in Note 17.

3. Drain engine cooling system.

4. Raise rear of car and remove clamp securing evaporator drain and remove drain.

5. Disconnect right and left mode door assemblies from blower motors and disconnect tan vacuum hoses.

6. Disconnect ambient air hoses from blower evaporator assembly.

7. Disconnect ambient and duct sensor leads.

8. Disconnect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum supply hose at connector where they enter luggage compartment below blower evaporator assembly.

9. Disconnect six way electrical connector from body wiring at right side of car.

10. Disconnect yellow and black vacuum hoses at right side of car.

11. Unsnap return air boot from blower evaporator assembly.

12. Remove screw securing bracket to package shelf.

13. Remove four screws securing brackets to floor pan.

14. Lift blower evaporator assembly out of luggage compartment.

b. Installation

1. Position blower evaporator assembly in luggage compartment.

2. Connect right and left mode door assemblies to blower evaporator outlets.

3. Connect tan vacuum hoses.

4. Connect return air boot to blower evaporator case.

5. Connect yellow and black vacuum hoses at right side.

6. Connect six-way electrical connector at right side.

7. Connect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum hose at connectors under blower evaporator assembly. Refer to Fig. 1-72. Recover low pressure hose with insulation.

8. Connect ambient and duct sensor leads.

9. Connect ambient air hoses to blower evaporator.

10. Secure lower brackets to floor pan with four cap screws.

11. Secure upper bracket to package shelf with screw.

12. Raise rear of car and install evaporator drain assembly.

13. Fill engine cooling system.

14. Evacuate system as described in Note 19.

15. Charge system as described in Note 21.

16. Replace trim panel inside luggage compartment.

78. POA Suction Throttling Valve (697 Rear)

a. Removal

1. Remove blower evaporator assembly as described in Note 77a.

2. Remove screw securing suction throttling valve clamp to case assembly.

3. Disconnect equalizer line.

4. Disconnect low pressure line from suction throttling valve.

5. Disconnect suction throttling valve from evaporator outlet pipe.

b. Installation

1. Connect suction throttling valve to evaporator outlet pipe.

2. Connect low pressure line to suction throttling valve, and cover with insulation.

3. Connect equalizer line to suction throttling valve.

4. Secure suction throttling valve to case assembly with clip and one screw.

5. Install blower evaporator assembly as described in Note 77b.

79. Evaporator Core

a. Removal

1. Remove blower evaporator assembly as described in Note 77a.

2. Remove 29 screws and 4 nuts holding evaporator case together and remove bottom of case.

3. Remove screw and clamp securing high pressure line to bottom of case assembly.

4. Disconnect suction throttling valve from evaporator outlet pipe.

5. Disconnect equalizer line from suction throttling valve.

6. Remove ambient air inlet fittings from case.

7. Remove four screws on top of case securing evaporator core to case and remove evaporator core from case.

8. Remove expansion valve from evaporator core as described in Note 80a.

b. Installation

1. Install expansion valve to evaporator core as described in Note 80b.

2. Position evaporator core in case assembly and secure with four screws.

3. Install ambient air inlet fittings on case.

4. Connect suction throttling valve to evaporator outlet pipe.

5. Connect equalizer line to suction throttling valve.

6. Position bottom of case on assembly and secure with 29 screws and 4 nuts.

7. Secure high pressure line to bottom of case with clamp and screw.

8. Install blower evaporator assembly as described in Note 77b.

80. Expansion Valve

a. Removal

1. Remove blower evaporator assembly as described in Note 77a.

2. Remove evaporator core assembly as described in Note 79a.

3. Remove power element bulb from evaporator outlet pipe.

4. Disconnect equalizer line from POA suction throttling valve.

5. Disconnect expansion valve from evaporator inlet.

b. Installation

1. Connect expansion valve to evaporator inlet.

2. Connect equalizer line to suction throttling valve.

3. Position power element bulb on evaporator outlet and secure.

4. Replace evaporator core assembly as described in Note 79b.

5. Replace blower evaporator assembly as described in Note 77b.

81. Heater Core

a. Removal

1. Remove blower evaporator assembly as described in Note 77a.

2. Remove inlet and outlet hoses from heater inlet and outlet pipes.

3. Remove 29 screws and 4 nuts securing evaporator case together.

4. Remove clamp and screw securing high pressure line to bottom of case.

5. Remove sealing grommet around heater inlet and outlet pipes.

6. Remove 6 screws securing temperature door baffle to case and remove baffle.

7. Remove 6 screws, 3 each side of case, securing heater core and baffle to case.

8. Lift heater core and baffle from case.

9. Remove 4 screws securing baffle to heater core and remove baffle.

10. Remove retainers from heater core.

b. Installation

1. Position retainers to heater core and secure baffle to retainers with 4 screws.

2. Position heater core in case and secure with 6 screws, 3 each side.

3. Install temperature door baffle.

4. Seal hole around heater inlet and outlet pipes with sealing grommet.

5. Position bottom of case on assembly and secure with 29 screws and 4 nuts.

6. Secure high pressure line to bottom of case with clamp and screw.

7. Install inlet and outlet hoses to heater core pipes.

8. Install blower evaporator assembly as described in Note 77b.

ELDORADO SYSTEMS

The service information that follows pertains only to the Fleetwood Eldorado Coupe. All other descriptions service procedures and recommendations for the Eldorado are the, same as those for the standard car, as given in the first part of this section.

Ventilation

The ventilation on the Eldorado when not equipped with Automatic Climate Control consists of two inlet systems and an exhaust system, Fig. 1-82.

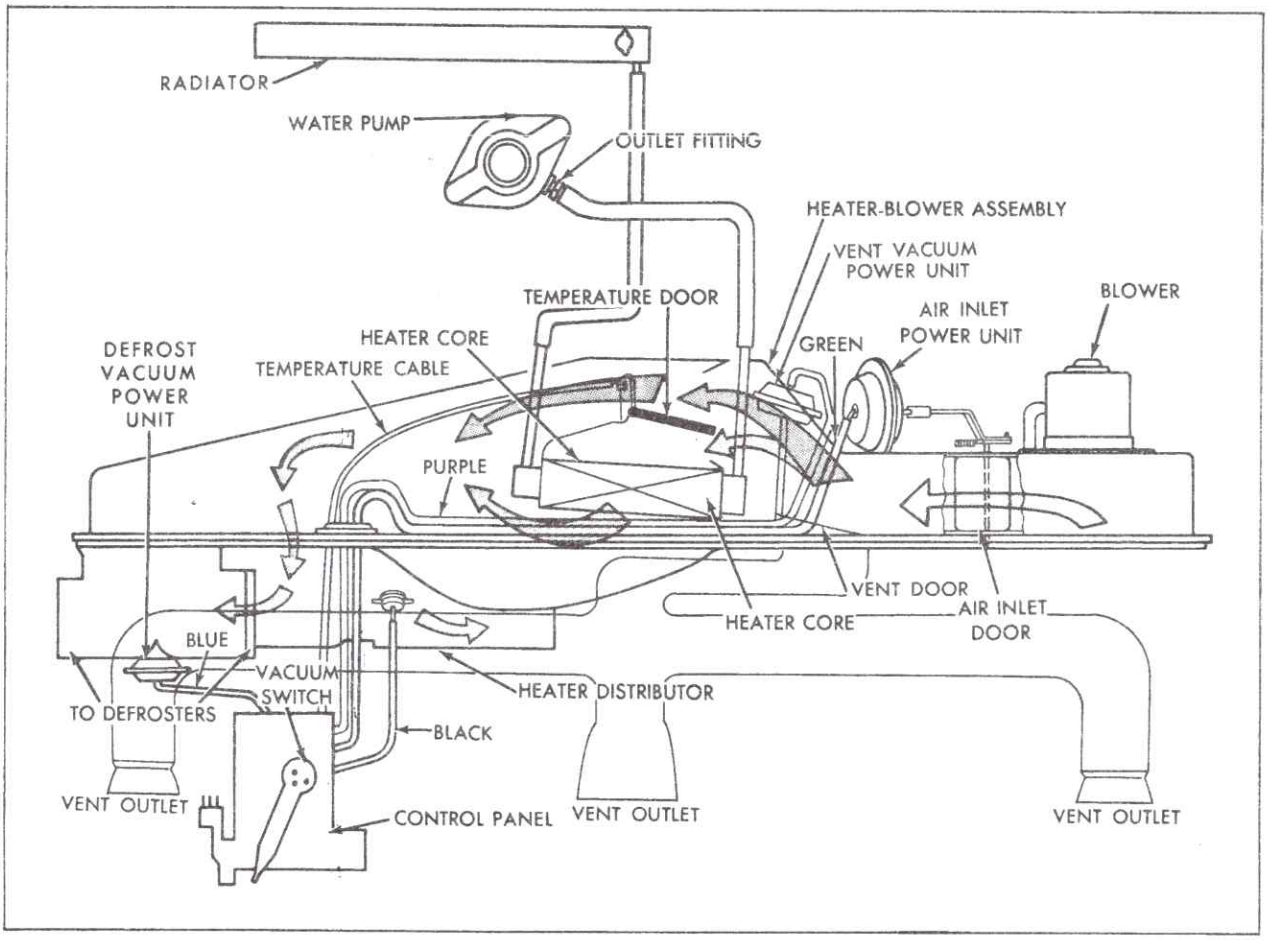


Fig. 1-79 Heater Components (693)

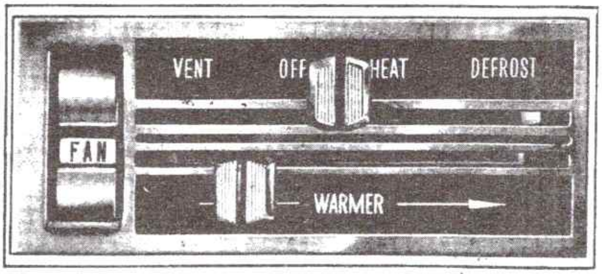


Fig. 1-80 Heater Control Panel (693)

The first inlet system consists of two fresh air intake doors controlled by knobs under each end of the instrument panel. This system introduces air into the passenger comparment for ventilation at the lower level.

The second system provides high level directional ventilation. This high level ventilation is provided to take the place of the ventilator windows, which are not used on this model. This high level ventilation is controlled by the Vent position on the heater control panel, Fig. 1-80, and the Fan switch. Air is introduced into the passenger compartment through outlets in the dash panel, Fig. 1-79. These outlets are the same outlets used for air conditioning when the car is equipped with Automatic Climate Control.

The ventilation exhaust system is used on all Eldorado cars. The exhausting air is routed out under the rear seat, up behind the rear seat back and out through pressure relief valves in the door lock pillars and at ventilator grilles in the rear quarter panel.

82. Temperature Door Cable Adjustment (693 Only)

1. Block temperature lever in the extreme "WARMER" position.

2. Turn plastic turnbuckle on control cable until temperature door seats on end of its travel toward left side of car.

83. Blower Resistor (693 Heater Only)

a. Removal

1. Disconnect multiple connector from blower resistor.

2. Remove two screws securing blower resistor to heater case and remove resistor.

b. Installation

1. Position blower resistor on heater case and secure with two screws.

2. Connect electrical connector to blower resistor.

84. Heater Blower Motor (693)

a. Removal

1. Remove rubber cooling hose from nipple and blower motor.

2. Disconnect electrical connector from blower terminal.

3. Remove five screws securing blower to heater case and remove blower.

b. Installation

1. Place a bead of sealer around opening where blower will contact case.

2. Position blower on case and secure with five screws.

3. Connect electrical connector to blower terminal.

4. Install cooling hose on motor and nipple.

85. Heater-Blower Assembly (693)

a. Removal

1. Drain cooling system.

2. Remove blower motor as described in Note 84a.

3. Remove left cowl to fender shield strut rod.

4. Remove heater hoses from fittings on heater-blower assembly leaving clamps on fittings.

5. Disconnect temperature bowden cable from temperature door operating lever and bracket. Position cable out of way.

6. Disconnect multiple connector from blower resistor.

7. Disconnect vacuum hoses from outside air door and vent diaphragms and position out of way.

8. Remove 12 screws securing heater-blower assembly to cowl.

9. Pull heater-blower assembly away from cowl and tipping blower end downward remove assembly from car.

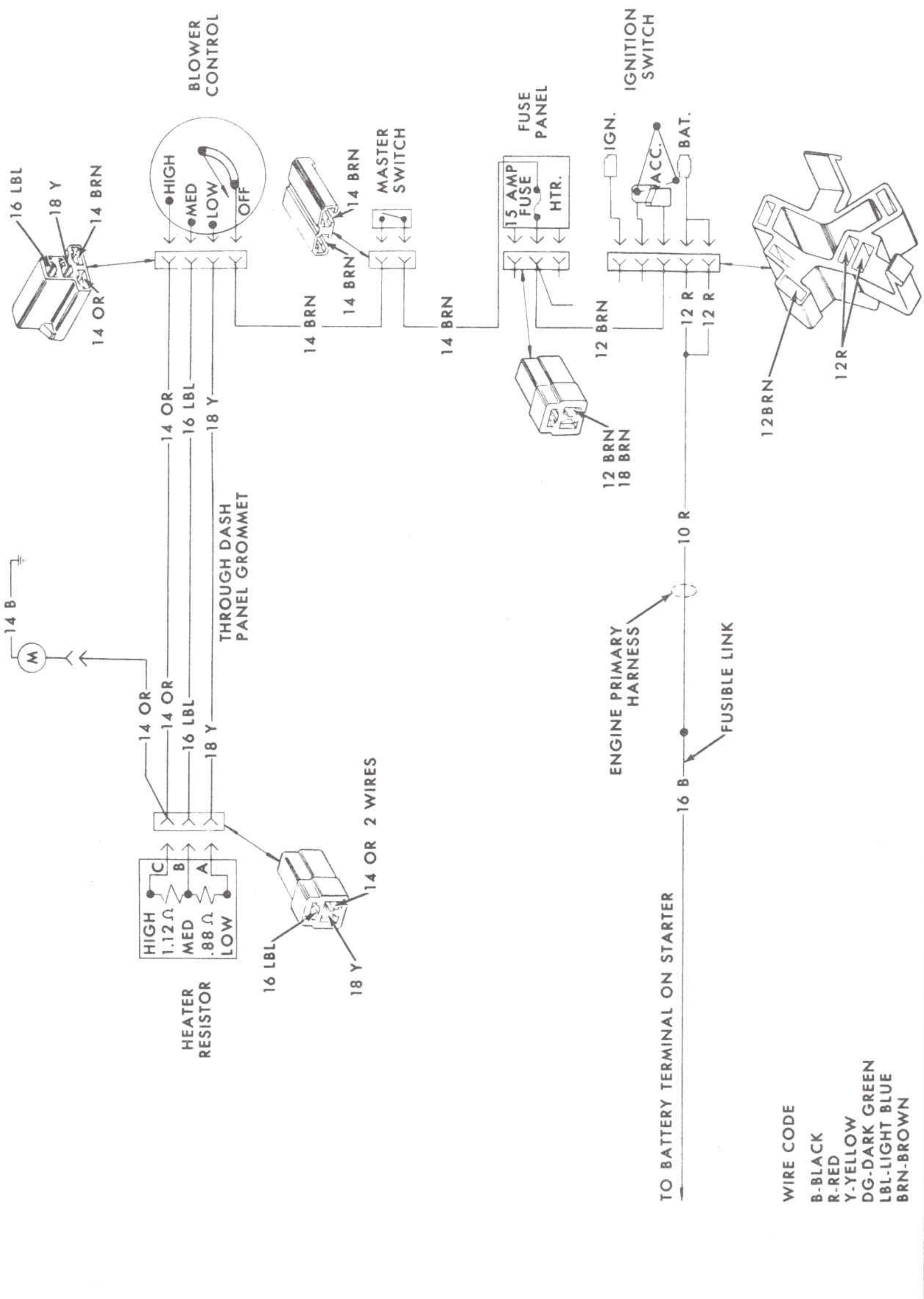


Fig. 1-81 Heater Circuit Diagram (693)

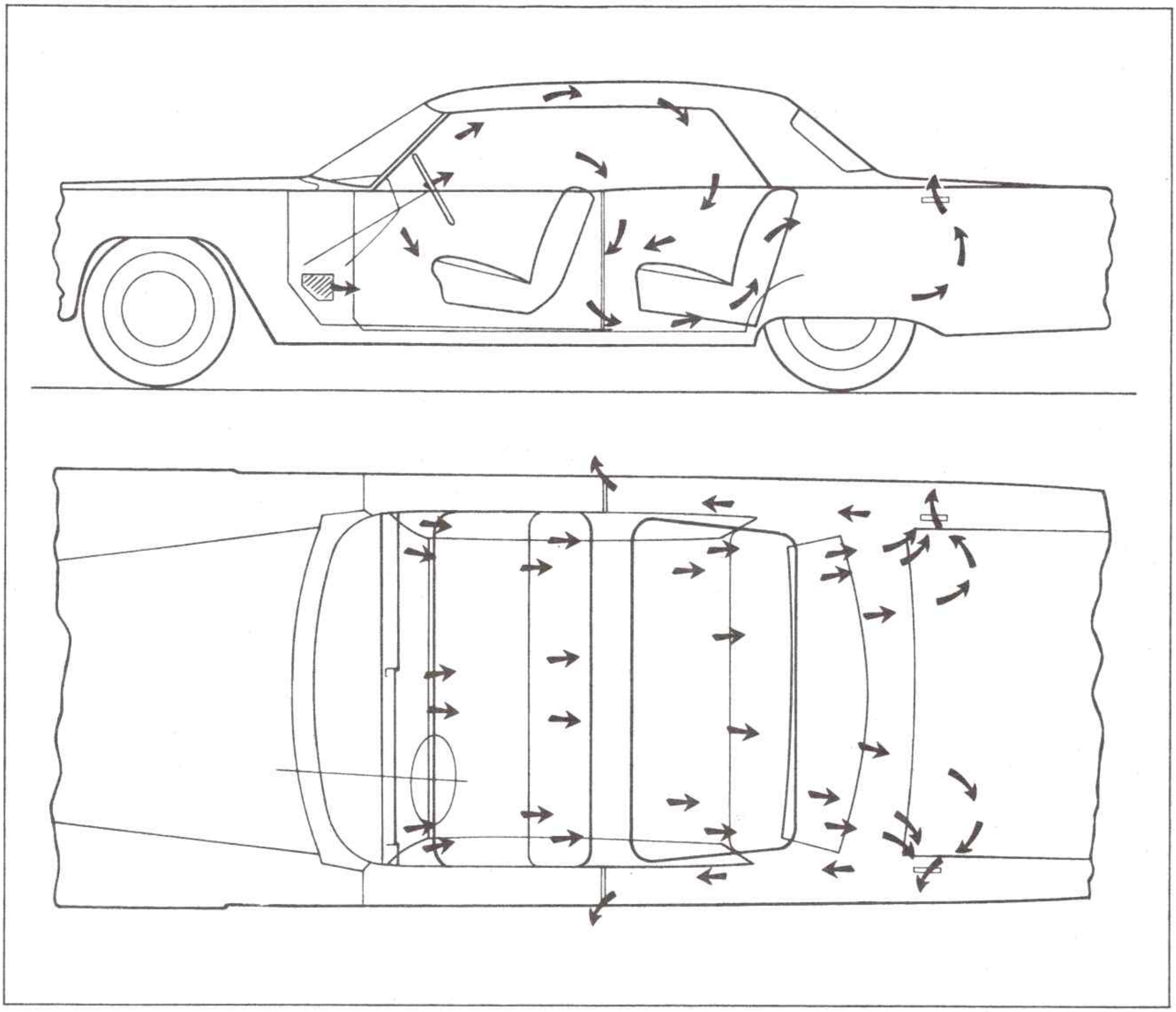


Fig. 1-82 Ventilation (693)

b. Installation

1. Place gasket around mounting flange where heater blower assembly will contact cowl.

2. Place heater-blower assembly to cowl and secure with 12 screws. The retainer clips directly behind the engine attach to the screw at the lower edge of the heater-blower assembly.

3. Connect multiple electrical connector to blower resistor.

4. Connect vacuum hoses to the outside air door and vent diaphragms. The purple hose attaches to the vent diaphragm.

5. Install temperature bowden cable and adjust as described in Note 82.

6. Connect heater hoses to nipples on front of heater blower assembly.

7. Install blower motor as described in Note 84b.

8. Install left cowl to fender shield strut rod.

9. Fill cooling system.

86. Heater Core (693)

a. Removal

1. Remove heater blower assembly as described in Note 85a.

2. Remove four screws, two each side of heater core, securing wire retaining clamps to heater-blower case, and remove retaining clamps.

3. Pull heater core out of heater-blower case.

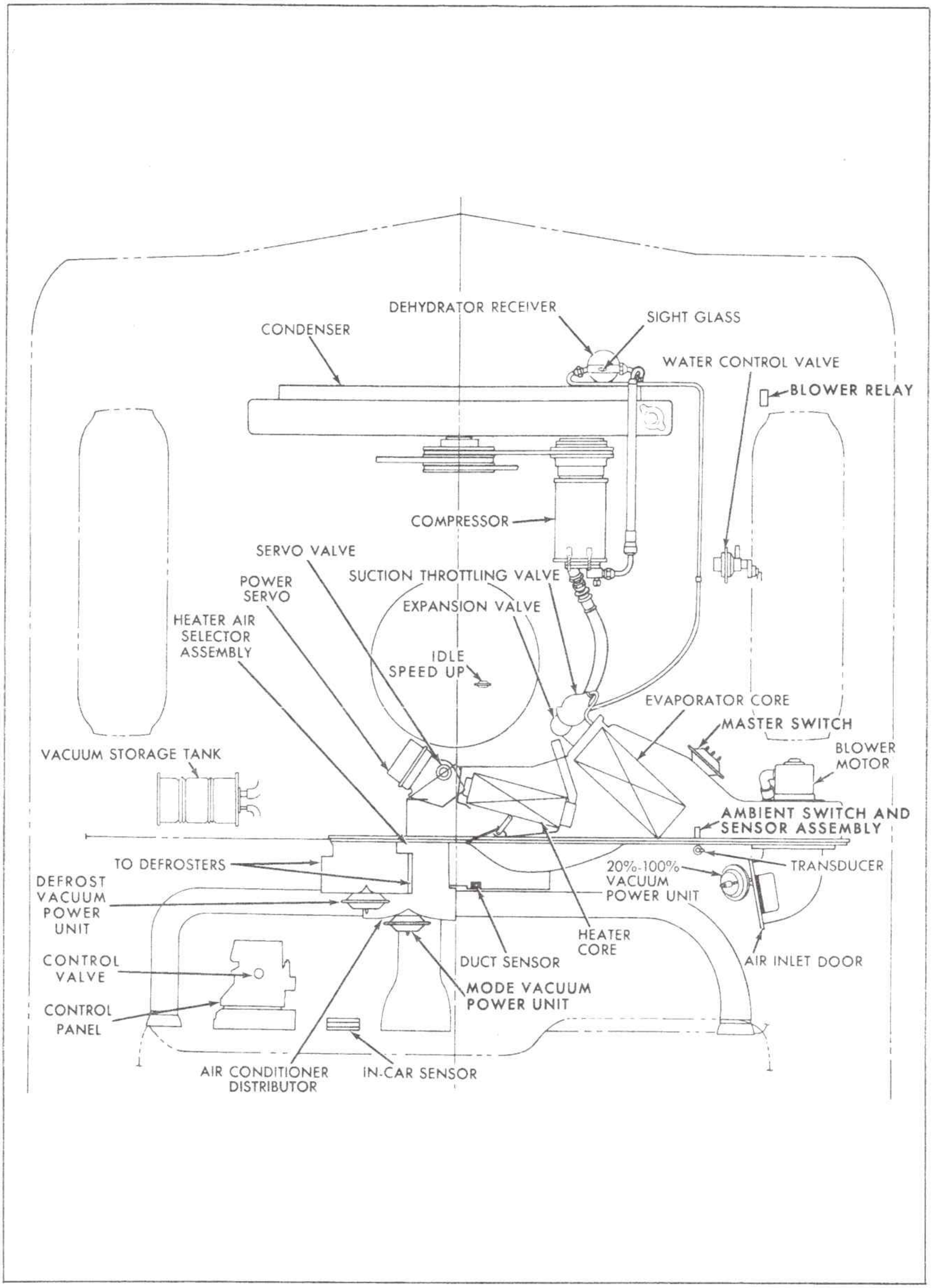


Fig. 1-83 Location of Units (693)

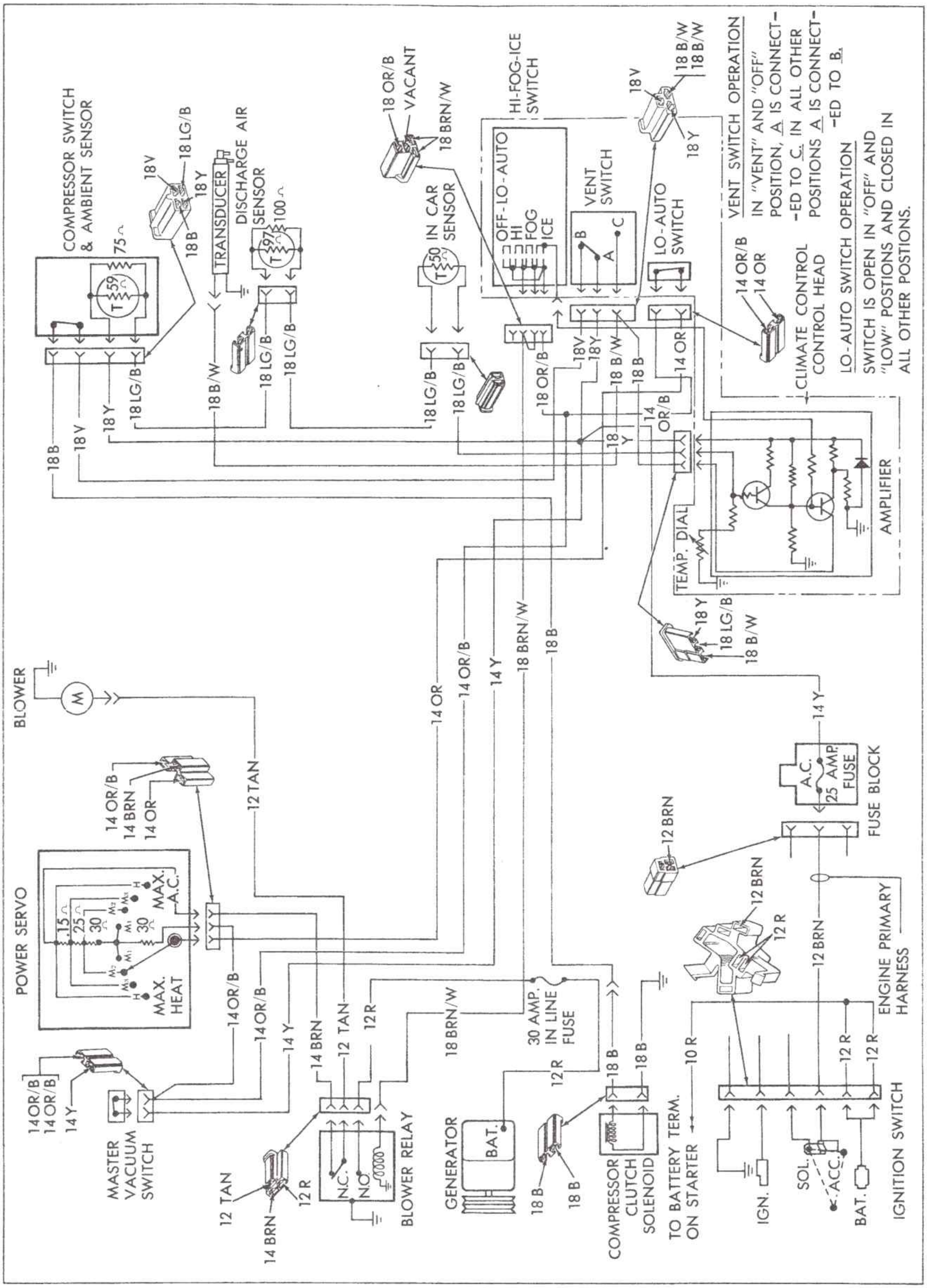


Fig. 1-84 Automatic Climate Control Electrical Circuit (693)

b. Installation

1. Form a bead of heavy bodied sealer around flange in heater-blower case that heater core contacts.

2. Position heater core in heater-blower case and secure with two wire retainers and four screws.

3. Check position of rubber grommets where nipples pass through heater-blower case. Reposition as required for sealing.

4. Install heater-blower assembly as described in Note 85b.

AIR CONDITIONING

87. Adjustments

Procedures for adjusting compressor belt tension are contained in Section 6, Note 50.

88. Duct Sensor (693 Only)

a. Removal

1. Disconnect electrical connector from duct sensor.

2. Remove three screws securing heat distributor to dash and to heater air selector and remove heat distributor.

3. Remove screw securing duct sensor to heat distributor and remove sensor.

b. Installation

1. Position duct sensor on heat distributor and secure with one screw.

2. Position heat distributor to dash panel and heater air selector with duct sensor tube protruding into air conditioning distributor. Secure with three screws.

3. Connect electrical connector to duct sensor.

89. Ambient Switch and Sensor Assembly

a. Removal

1. Open hood.

2. Disconnect Ambient Switch and Sensor connector from harness.

3. Remove two screws securing Ambient Switch and Sensor Assembly to cowl panel and remove sensor and gasket.

b. Installation

1. Position Ambient Switch and Sensor Assembly, and gasket, to cowl panel and secure with two screws.

2. Connect electrical connector to harness connector.

3. Seal the ambient switch and sensor assembly to prevent entrance of moisture.

4. Close hood.

90. Compressor Removal and Installation (Complete) (693 Only)

a. Removal

1. Remove carburetor air cleaner.

2. Purge system as described in Note 17.

3. Remove Allen screw securing suction and discharge connector to rear head, and remove connector, with lines attached, from compressor.

4. Cover openings in both compressor and connector to keep dirt out. Use Test Plate, J-9527 over compressor openings.

5. Loosen generator and remove drive belts from compressor pulley.

6. Disconnect electrical connector from clutch coil terminals.

7. Remove two screws securing compressor front mounting flange to mounting bracket.

8. Remove two screws securing rear of compressor to mounting bracket and remove compressor. Loosen rear support to manifold screws.

b. Installation

NOTE: Before installing a replacement compressor, make certain the numeral 4 is stamped 1/8 inch high on blank space provided in lower right hand corner of compressor name plate. If numeral is not evident, then stamp numeral as indicated. This numeral indicates the refrigerant capacity and must be shown on all compressors as required by law in some states.

1. Position compressor between mounting brackets on engine and install two screws securing it to rear bracket. Generator brace goes under head of right screw. Tighten rear support to manifold screws.

2. Secure front compressor flange to front mounting bracket with two screws.

3. Connect electrical connector to clutch coil terminals.

4. Install drive belts on pulley and adjust as described in Section 6, Note 50.

5. Remove Test Plate, J-9527 from compressor and using new O-rings, position suction and discharge connector to rear head and install Allen screw. Tighten screw to 15 foot pounds.

6. Evacuate system as described in Note 19.

7. Charge system as described in Note 21. Leak test all compressor connections.

CAUTION: All leaks must be repaired. Under no circumstances should a compressor be operated when a leak exists, as complete loss of refrigerant prevents oil return to the compressor.

8. Install air cleaner.

91. Compressor Removal and Installation (Partial) (693 Only)

a. Removal

1. Remove carburetor air cleaner.

2. Perform steps 5 through 8, Note 90a.

3. Move complete assembly clear of working area being careful not to kink hoses. Wire compressor to a convenient location.

b. Installation

1. Perform steps 1 through 4, Note 90b.

2. Install carburetor air cleaner.

92. Master Switch (693 Only)

a. Removal

1. Disconnect vacuum hoses from master switch.

2. Disconnect electrical connector from master switch.

3. Remove two screws securing master switch mounting bracket to evaporator case and remove master switch and mounting bracket.

4. Uncap unused port of master switch.

5. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.

2. Place cap on one port of master switch.

3. Position master switch mounting bracket to evaporator case and install two screws securing mounting bracket to evaporator case.

4. Connect electrical connector to master switch.

5. Install vacuum hoses to master switch.

93. Condenser (693)

a. Removal

1. Remove dehydrator-receiver as described in Note 56a.

2. Position radiator overflow hose out of way.

3. Disconnect high pressure vapor line at fitting on top right side of condenser.

4. Remove four nuts, two each side, securing condenser mounting brackets to rubber mounts.

5. Lift condenser upward, disengaging it from rubber mounts. When lower mounting brackets on condenser come under upper mounts, tip top of condenser forward to allow mounting brackets to clear mounts and lift condenser out of car.

b. Installation

1. Add refrigeration oil as described in Note 23.

2. With top of condenser tipped forward lower condenser into position until lower mounting brackets will go under upper rubber mounts. Tip condenser vertical and lower it until all four mounting brackets are resting on rubber mounts.

3. Secure mounting brackets to rubber mounts with four nuts, two each side.

4. Reposition radiator overflow hose.

5. Connect high pressure vapor line at fitting.

6. Install dehydrator-receiver as described in Note 56b.

AIR CONDITIONING DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	REMEDY
Automatic Climate Control system operates only at maximum cooling and HIGH blower.	Control lever in HI position (Front Only).	Instruct owner.
	Defective transducer.	Replace transducer.
	Defective amplifier.	Replace amplifier.
	No vacuum supply to power servo diaphragm.	Check vacuum circuit for pinched, damaged, or disconnected hoses.
	Defective temperature dial rheostat.	Replace dial assembly.
	Wire to temperature dial rheostat disconnected.	Connect wire.
	Defective power servo unit.	Replace power servo unit.
	Shorted in-car sensor.	Replace sensor.
	Defective power servo unit vacuum valve.	Replace vacuum valve.
	Temperature door link disconnected.	Connect link.
	Power servo stuck.	Remove obstruction.
Automatic Climate Control system operates only at maximum heating and HIGH blower.	Control lever in HI position (Front only).	Instruct owner.
	Defective transducer.	Replace transducer.
	Amplifier connector loose or disconnected.	Connect connector.
	Defective amplifier.	Replace amplifier.
	Poor ground at transducer case or servo casting.	Check grounds.
	In-Car sensor wire disconnected.	Connect sensor wire.
	Defective in-car sensor.	Replace sensor.
	Electrical connector at in-car duct, or ambient sensor disconnected.	Connect connector.
	Poorly crimped terminal at sensor connectors.	Solder terminals to wire.
	Control panel not grounded.	Check control panel.
	Open circuit in wiring.	Check car wiring.
	Short to ground in sensor string.	Repair short.
	Defective temperature dial rheostat.	Replace temperature dial rheostat.

AIR CONDITIONING DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
No air flow from air conditioning outlets.	Control set to FOG position. (Front unit only)	Instruct owner.
	Shut off valves in air outlets closed in front systems.	Instruct owner.
	Loose connector or open circuits in wiring.	Tighten connector or repair circuit.
	Open circuit in blower motor.	Replace blower motor.
	Blown fuse.	Replace fuse.
	Master switch not closing.	Replace master switch.
	Blower disconnected.	Connect blower.
	Multiple connector on power servo disconnected.	Connect connector.
	Defective vacuum valve on control panel.	Replace valve.
Insufficient air flow from air conditioning outlets.	Control set for LO operation. (Front units only)	Instruct owner.
	Loose flexible hose feeding right or left air outlet.	Attach hose securely.
	Loose air boot feeding center outlet on front systems.	Attach boot securely.
	Obstruction in air hoses, ducts or passageways.	Remove obstruction.
	Defective power servo circuit board.	Replace power servo unit.
	Defective blower resistor.	Replace blower resistor.
	Defective Lo-Auto switch.	Replace switch.
	Evaporator icing.	Replace suction throttling valve.
	Shut off valves in air outlets partially closed on front systems.	Instruct owner.
Air comes out heater instead of air conditioning outlets.	Control set to FOG position. (Front unit only)	Instruct owner.
	No vacuum supply to mode door vacuum power unit.	Check vacuum circuit for pinched, damaged, or disconnected hoses.

AIR CONDITIONING DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Air comes out heater instead of air conditioning outlets. (Cont'd.)	No vacuum supply to mode door vacuum power unit. (Cont'd.)	Check operation of vacuum check valve and vacuum valves. Replace if necessary. Check air door operation. Replace vacuum power unit or repair linkage at air door.
Air comes out some air conditioning outlets but not others.	Shut-off valves in front air outlets closed.	Instruct owner.
	Hose disconnected from outlet.	Connect hose.
Air flow drops off at times.	Evaporator core freezes.	Replace suction throttling valve.
Insufficient cooling - Air from air conditioning outlets is not cold.	Control lever in VENT position.	Instruct owner.
	No refrigerant in system.	Leak test, repair and recharge system.
	System low on refrigerant.	Check for leak, repair and add refrigerant.
	Power servo adjusting link misadjusted.	Adjust link.
	Defective transducer.	Replace transducer.
	Defective ambient switch.	Replace ambient switch.
	Open ambient or duct sensor.	Replace sensor.
	Defective amplifier.	Replace amplifier.
	Ambient, duct or in-car sensor touching cold object.	Remove object.
	Duct sensor hose kinked, plugged or disconnected on front systems.	Repair or replace hose.
	Ambient switch contacts dirty.	Clean ambient switch.
	Compressor inoperative. No voltage at clutch coil.	Find cause of no voltage and correct.
	Vent switch defective.	Replace switch.
	Compressor clutch slipping.	Replace clutch plate and hub assembly.
	Compressor belt slipping.	Tighten belt or eliminate cause of belt slippage.
	Suction throttling valve controls evaporator pressure higher than 29 psi for front units, 27 psi for 697 rear units.	Replace suction throttling valve.

AIR CONDITIONING DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Insufficient cooling - Air from air conditioning outlets is not cold. (Cont'd.)	Suction throttling valve controls evaporator pressure lower than 29 psi for front units, 27 psi for 697 rear unit, resulting in icing of evaporator and loss of cooling air flow.	Replace suction throttling valve.
	Expansion valve thermal bulb and capillary discharged - causing valve to close tight.	Replace expansion valve.
	Expansion valve stuck wide open, allowing too much flow of refrigerant to evaporator.	Replace expansion valve.
	Expansion valve inlet screen clogged, restricting flow of refrigerant to evaporator.	Clean screen - also clean compressor inlet screen.
	Clogged dehydrator receiver.	Replace unit.
	Condenser air flow reduced by bugs, leaves, etc. - indicated by high head pressure.	Clean condenser.
	Excessive refrigerant in system - indicated by high head pressure.	Purge excessive refrigerant from system and recharge system to correct amount.
	Excess oil in system.	Remove oil as required.
	Air in refrigeration system - indicated by non-equalization of high and low side pressures overnight.	Purge air from high side fitting until pressures equalize.
	Refrigerant hose or tubing collapsed, kinked or otherwise damaged interferring with flow of refrigerant.	Replace damaged hose or tubing.
	Compressor inlet screen at suction fitting clogged.	Clean screen - also clean expansion valve screen.
	Compressor not pumping sufficiently.	Repair compressor.
	Compressor inoperative - seized.	Repair or replace compressor.
	Front system uses outside air only and will not switch to recirculated air in HI position - which gives maximum cooling capacity.	Check and repair vacuum system to obtain proper "Cool" and "Recirc" operation.

AIR CONDITIONING DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Insufficient cooling - Air from air conditioning outlets is not cold. (Cont'd.)	Water control valve remains open in maximum cooling position.	Check to assure that vacuum to valve diaphragm is supplied at maximum cooling position.
		Check operation of vacuum control valve. Replace if necessary.
		Replace water control valve.
	Leakage of hot air around temperature door or mispositioned temperature door.	Adjust or repair temperature door.
	Leakage of hot air into passenger compartment through dash or floor pan openings, at grommets, around door openings, through or around heater, etc.	Correct leakage of hot air into car from whatever source.
High blower speed in VENT position.	Lo Auto switch stuck closed.	Replace switch.
Fixed Low blower speed in Auto position.	Lo Auto switch stuck open.	Replace switch.
Fixed high blower speed in all positions including OFF.	Blower relay stuck in HIGH blower position.	Replace blower relay.
No fixed high blower speed in Hi or ICE positions.	Blower relay stuck in Normal position.	Replace blower relay.
	Blower relay coil open.	Replace blower relay.
		Check car wiring.
No blower in HI or ICE positions.	Blown in line fuse.	Replace fuse.
		Check car wiring.
Insufficient Heat.	Defective amplifier.	Replace amplifier.
	Defective transducer.	Replace transducer.
	Heater capacity reduced.	Check level of engine coolant.
		Check for kinked or plugged water lines.
	Water control valve stuck in closed position.	Replace water control valve.
Automatic Climate Control system blows cold air at start.	Defective vacuum leakage plug.	Replace vacuum leakage plug.
	Defective thermal vacuum valve.	Replace water control valve.
	Restrictor missing.	Replace restrictor.

AIR CONDITIONING DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Low head pressure as indicated by performance test.	Insufficient refrigerant in system.	Leak test, repair and recharge system.
	Suction throttling valve or expansion valve stuck open - allowing too much refrigerant flow to compressor.	Replace suction throttling valve or expansion valve if necessary.
	Compressor not pumping at full capacity.	Repair compressor.
Noise or vibration.	Loose compressor belt.	Adjust belt tension.
	Loose compressor mountings.	Tighten compressor mountings.
	Damaged compressor shell or worn internal parts.	Repair or replace compressor.
	Defective expansion valve.	Replace expansion valve.
	Defective blower motor.	Replace blower motor.
Objectionable odors being discharged through air conditioning outlets.	Front system operates on RECIRC air at all times.	Check and repair vacuum system to obtain proper operation.
	Odor-producing substances deposited on evaporator core.	Wash evaporator core.

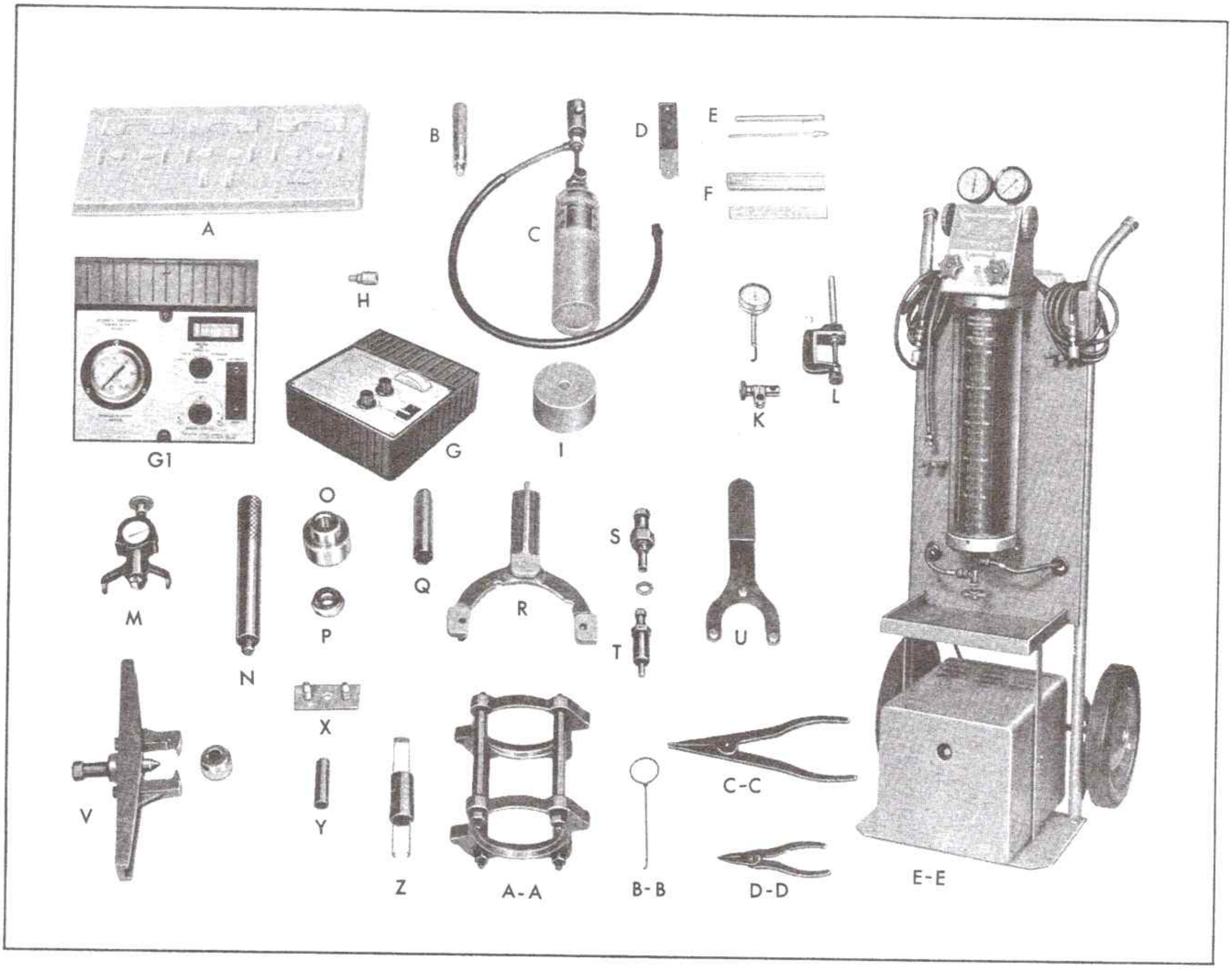


Fig. 1-85 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-9402	Parts Tray	P	J-9481	Pulley and Bearing Installer
B	J-9432	Needle Bearing Installer	Q	J-9392	Seal Remover and Installer
C	J-6084	Leak Detector Torch	R	J-9396	Holding Fixture
D	J-21530	Temperature Dial Adjuster	S	J-9401	Clutch Plate and Hub Assembly Remover
E	J-5421	Thermometer	T	J-9480	Clutch Plate and Hub Assembly Installer (2 pcs.)
F	J-6076	Humidicator	U	J-9403	Clutch Hub Holding Tool
G	J-21512	Automatic Climate Control Tester	V	J-8433	Pulley Puller
G1	J-22368-01	Automatic Temperature Control Tester	W	J-9395	Puller Pilot
H	J-5420	Gage Adapter (2 Required)	X	J-9399	9/16" Thin Wall Socket
I	J-9521	Internal Assembly Support	Y	J-9527	Test Plate
J	J-8001-3	Dial Indicator	Z	J-9393	Seal Seat Remover and Installer (2 pcs.)
K	J-8001-2	Sleeve			
L	J-8001-1	Clamp	A-A	J-9397	Compressor Fixture
M	J-7316	Tension Gage	B-B	J-5139	Oil Pick-Up Tube Remover
N	J-8092	Universal Handle	C-C	J-6435	Snap Ring Pliers (#26)
O	J-9398	Pulley Bearing Remover	D-D	J-5403	Snap Ring Pliers (#21)
			E-E	J-8393	Charging Station

TORQUE SPECIFICATIONS—METAL TUBING

Metal Tube O.D. In Inches	Thread and Fitting Size In Inches	Steel Tubing Torque Ft. Lbs.*	Aluminum or Copper Tubing Torque Ft. Lbs.*	Normal Torque Wrench Span In Inches
1/4	7/16	15	7	5/8
3/8	5/8	35	13	3/4
1/2	3/4	35	13	7/8
5/8	7/8	35	21	1-1/16
3/4	1-1/16	35	28	1-1/4

*Torque taken with crow foot attachment at a 90° angle on torque wrench.

GENERAL DESCRIPTION

The swept torque-box perimeter type frame, Fig. 2-1, is used on all 1967 model Cadillac automobiles, except the 693 model. The frame used on the 693 model is covered at the back of this section.

The frame is of fully boxed construction throughout its entire length. It encircles the passenger compartment with heavy side members and permits a lower floor with adequate seat height. This frame design also allows a small floor tunnel, and simplifies propeller shaft arrangement. Braced dual cross members support the front suspension and the engine front mounts. Two boxed supports and a cross member are provided for the engine rear mount.

A center bearing cross member is provided on the frames on Fleetwood Seventy-Five and the Commercial Chassis to support the center bearing of the two piece propeller shaft used on these models. This center bearing cross member is located between the number 3 and number 4 body mounting locations.

The perimeter type frame used on the 1967 Commercial Chassis is similar to the passenger car frame, but it has heavier construction features and incorporates a lower rear kick-up to meet the requirements of the flat floors used on commercial vehicles.

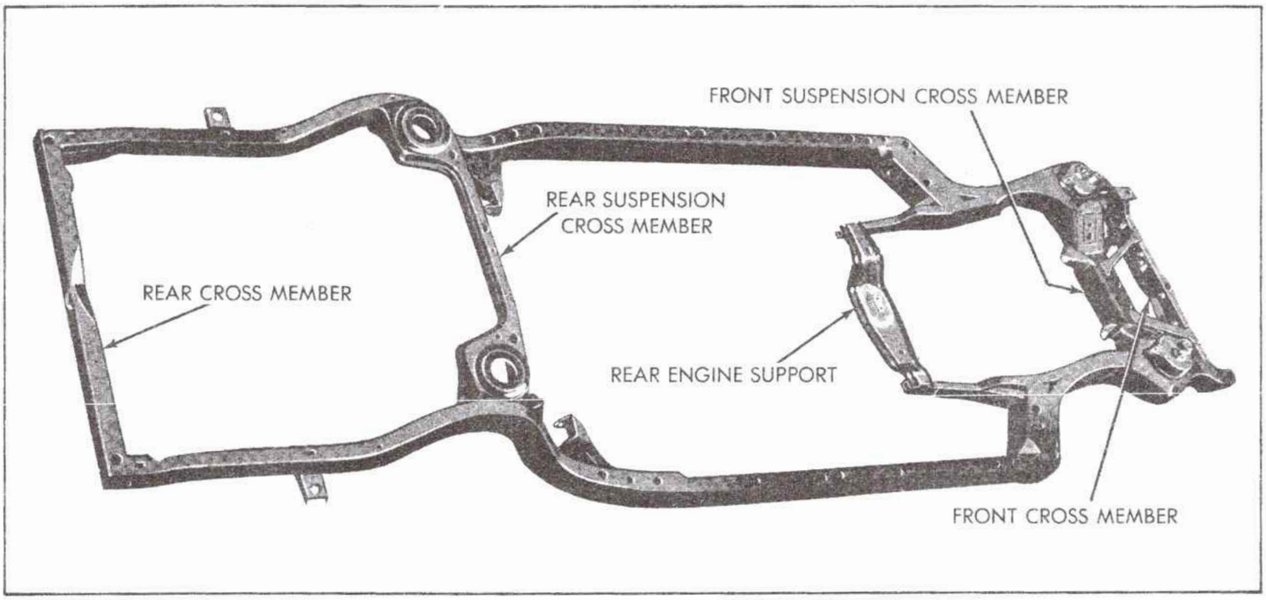


Fig. 2-1 Perimeter Frame

SERVICE INFORMATION

1. Body Mounts

Locations of body mount holes in the frames of all 1967 model cars, except the 693, are shown in Fig. 2-2. Cross sectional views of the parts required for installation of body mounts, showing the order of assembly, appear in Fig. 2-3. The code letters in the frame diagram and their corresponding cross sections indicate the installation required at all body mount locations for each 1967 body style.

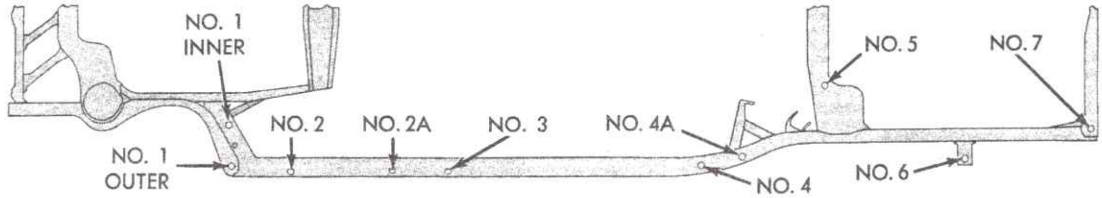
The actual number of shims used may vary with each installation, Fig. 2-3. Use the quantity necessary to fill the gap remaining between the body and frame after the mounting pads are installed. The correct number of shims required at each mount location may be determined by attempting to rotate the pad between the body and the frame. If the pad can be rotated with the fingers, add body shims until pad can no longer be rotated.

2. Checking Frame For Twist

1. Place car on section of level floor, and inflate tires to proper pressure.

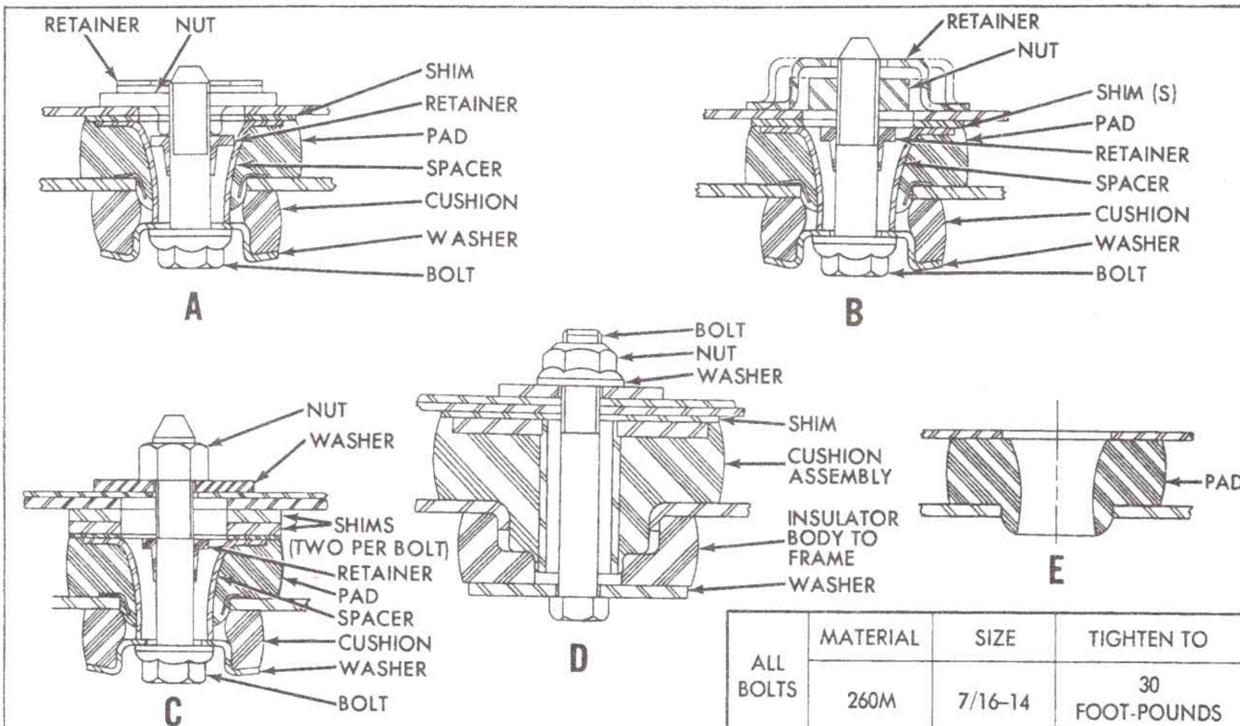
2. Measure distance from top of extreme front end of left side rail to floor. Repeat measurement for right side rail.

3. If front ends of right and left side rails are not the same distance from floor, raise low side rail with a jack until distances are equal.



SERIES	NO. 1 INNER	NO. 1 OUTER	NO. 2	NO.2A	NO. 3	NO. 4	NO. 4A	NO. 5	NO. 6	NO. 7
COUPES AND PILLAR SEDANS	D	C	—	—	—	—	B	B	B	B
STUB PILLAR SEDANS, FLEETWOOD SIXTY SPECIAL SEDAN & BROUGHAM	D	C	—	—	—	—	B	B	B	B
CONVERTIBLE	C	C	—	E	—	—	B	B	B	B
FLEETWOOD SEVENTY-FIVE	D	C	A	—	—	—	B	B	B	B

Fig. 2-2 Body Mounting Locations (Except 693)



	MATERIAL	SIZE	TIGHTEN TO
ALL BOLTS	260M	7/16–14	30 FOOT-POUNDS

Fig. 2-3 Body Mounts (Except 693)

4. Measure distance from extreme rear end of top of left rear side rail to floor. Repeat for right side rail.

5. Any difference in these dimensions greater than one-half inch is an indication of a twisted frame.

6. If frame is found to be twisted after checking the overall dimensions, measure distances from similar points on each side rail to floor, starting from front of frame. The twist is between the first points where a difference is found and the last where the distances were equal.

3. Checking Frame Dimensions

Refer to frame checking locations, Fig. 2-4. The car should be on a flat, level floor to assure accurate measurements when either of the following methods are used.

The easiest and most accurate method of checking frame dimensions is by use of tram gages. When using tram gages, be sure to keep the gage cross bar level to insure accuracy in all measurements.

The "plumb bob" method may be used for measuring frame dimensions if tram gages are not available. Using this method, it is only necessary to have a piece of cord attached to an ordinary surveyor's plumb bob. When measuring the distance between two points, the free end of the cord should be placed at one of the points and a mark made on the floor exactly under the plumb bob. This operation should be repeated at the other point, and the distance between chalk marks on the floor may be easily measured.

NOTE: The following dimensions apply to all styles except the 693 unless otherwise noted.

A - Width of front cross member: 39-1/4".

B - Maximum span of frame at front suspension cross member: 45-11/16".

C - Outer #1 left location to outer #1 right location: 58-5/8".

D - Width of rear cross member: 50-1/2", Commercial Chassis 54-1/2".

E - Front vertical surface of front cross member to centerline of front wheels: 18-3/8".

F - Centerline of front wheel to outer #1 location: 25-1/4".

G - Outer #1 location to #4 location: 73-21/32", Commercial Chassis 98-5/16", Fleetwood Sixty Special Sedan and Fleetwood Brougham 77-5/32", Fleetwood Seventy-Five 93-31/32".

H - Number 4 location to centerline of rear wheels: 30-5/8", Commercial Chassis 32-1/2".

I - Centerline of rear wheels to rear vertical surface of rear cross member: 48-1/4", Commercial Chassis 47-1/4".

J - Height of top surface of front cross member above normal top surface of side rail at #1 outer location: 3".

K - Height of top surface of side rail at front suspension cross member above normal top surface of side rail at #1 outer location: 6-3/4".

L - Height of top surface of rear suspension cross member at centerline of rear wheels above

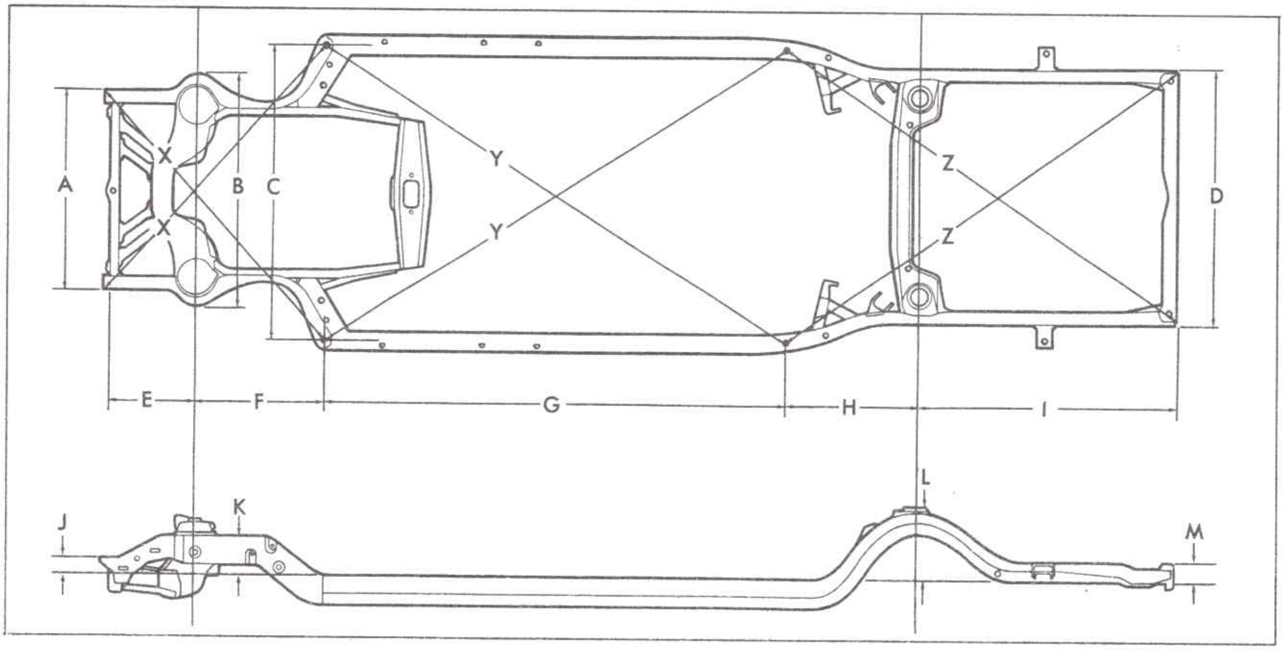


Fig. 2-4 Frame Checking Locations (Except 693)

normal top surface of side rail at #1 outer location: 12-1/4", Commercial Chassis 6-1/2",

M - Height of top surface of rear cross member above normal top surface of side rail at #1 outer location: 2-1/4".

Dimensions for X, Y, and Z are not given, as they illustrate points for taking diagonal measurements for checking the squareness of the frame. Easily identifiable features of the frame are located at the approximate terminal points of the arrows and should be used in making these measurements.

ELDORADO FRAME

GENERAL DESCRIPTION

The Fleetwood Eldorado Coupe frame is of fully boxed construction. The frame encircles the passenger compartment ending at the rear seat location. This is done to provide maximum space utilization at the rear of the automobile. Rear structural requirements are met by a sub frame that is part of the body assembly.

In addition to the crossmembers that are part of the frame assembly, Fig. 2-5, a bolt in torsion bar crossmember is fastened through rubber mounts to two brackets on the frame. This crossmember anchors the ends of the front suspension torsion bars to the frame assembly.

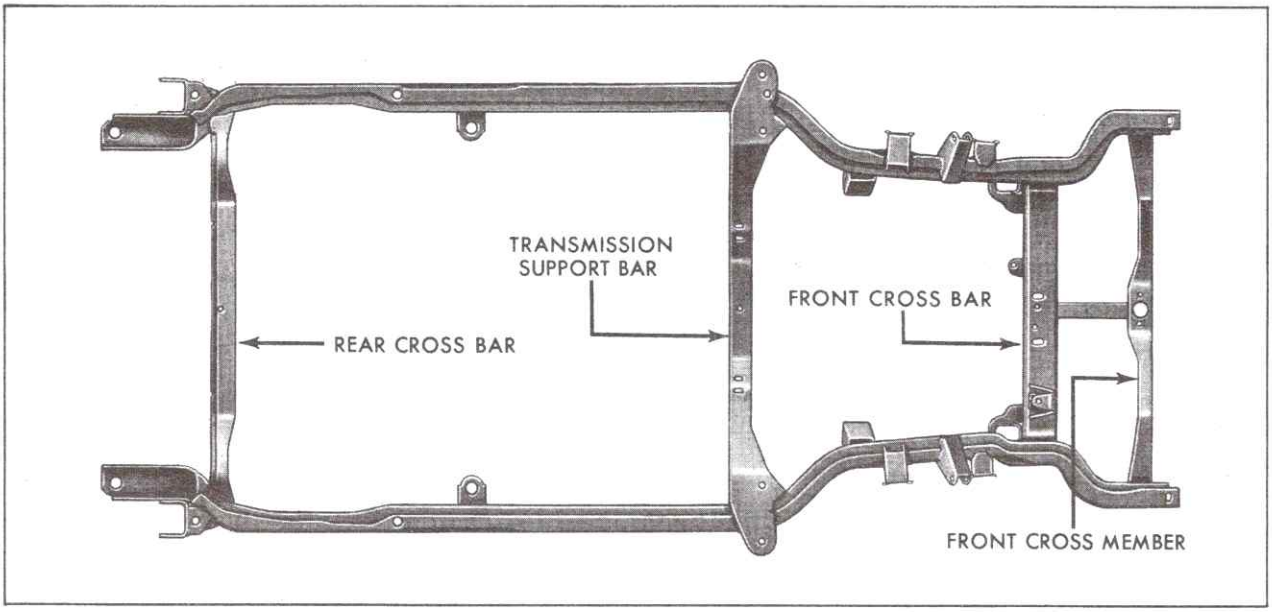


Fig. 2-5 Frame (693)

SERVICE INFORMATION

4. Body Mounts

Locations and exploded views of body mounts used on the 693 series are shown in Fig. 2-6.

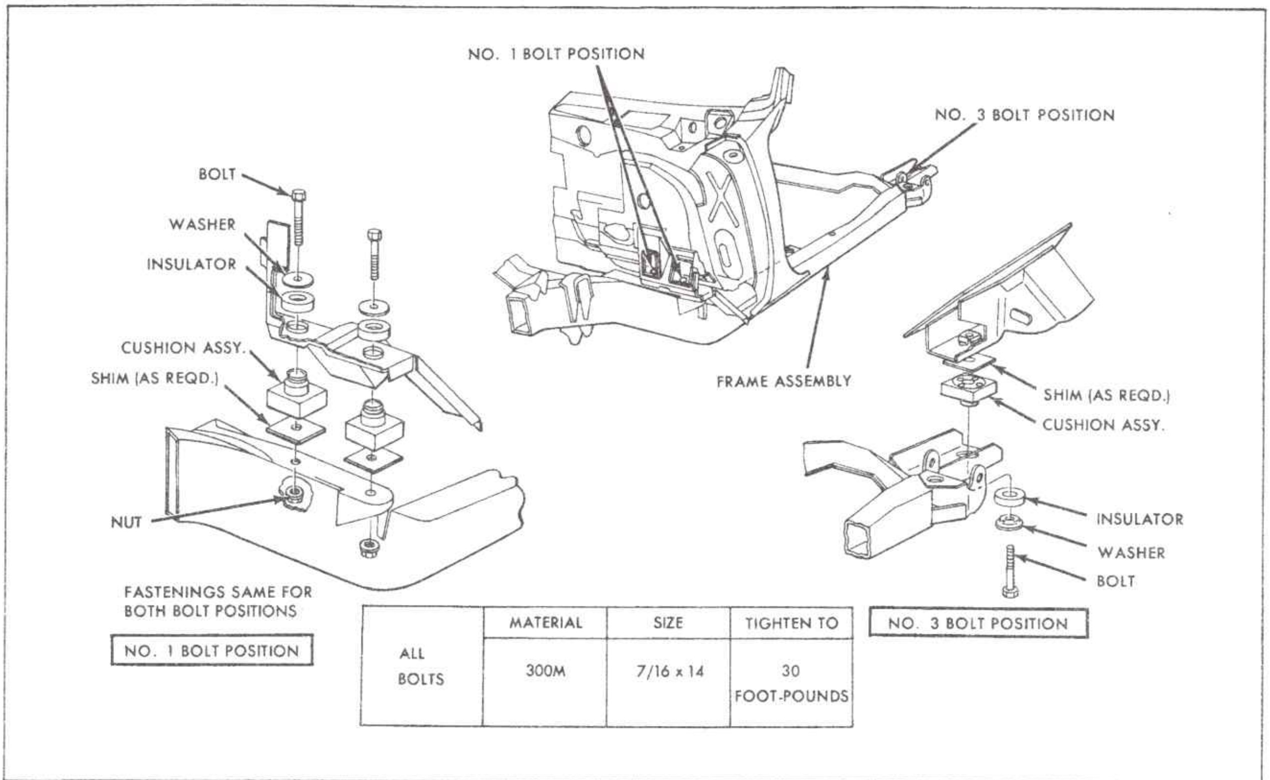
The actual number of shims used may vary with each installation. Use the quantity necessary to fill the gap remaining between the body and frame after the mounting pads are installed. The correct number of shims required at each mount location may be determined by attempting to rotate the pad between the body and the frame. If the pad can be rotated with the fingers, add body shims until pad can no longer be rotated.

5. Checking Frame Dimensions

Refer to frame checking locations, Fig. 2-7. The car should be on a flat, level floor to assure accurate measurements when either of the following methods are used.

The easiest and most accurate method of checking frame dimensions is by use of tram gages. When using tram gages, be sure to keep the gage cross bar level to insure accuracy in all measurements.

The "plumb bob" method may be used for measuring frame dimensions if tram gages are



	MATERIAL	SIZE	TIGHTEN TO
ALL BOLTS	300M	7/16 x 14	30 FOOT-POUNDS

Fig. 2-6 Body Mounts (693)

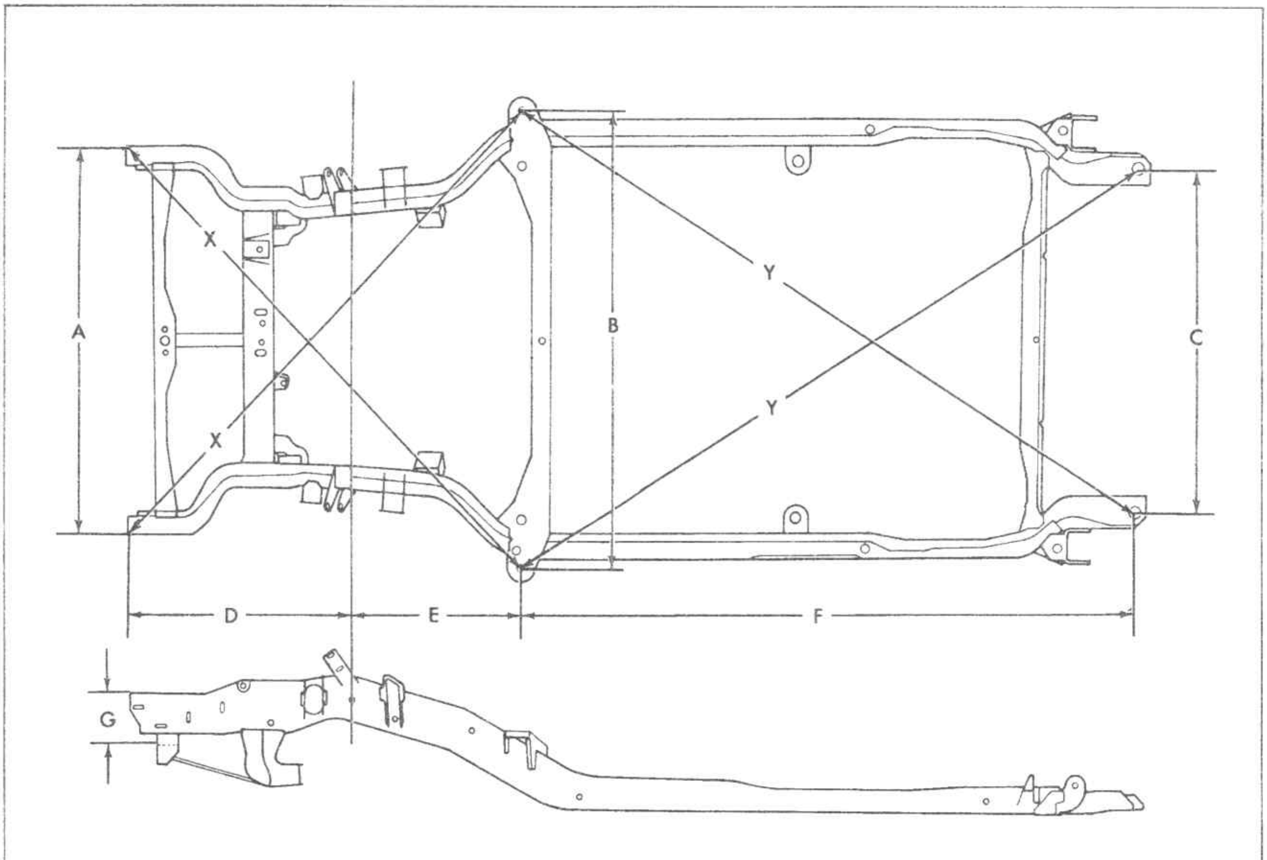


Fig. 2-7 Frame Checking Locations (693)

not available. Using this method, it is only necessary to have a piece of cord attached to an ordinary surveyor's plumb bob. When measuring the distance between two points, the free end of the cord should be placed at one of the points and a mark made on the floor exactly under the plumb bob. This operation should be repeated at the other point, and the distance between chalk marks on the floor may be easily measured.

A - Width of front cross member: 46-27/32".

B - Outer #1 left body bolt to outer #1 right body bolt: 54-13/16".

C - Number 3 left body bolt to #3 right body bolt: 40-15/16".

D - Front vertical surface of front cross member to centerline of front wheels: 27-11/16".

E - Centerline of front wheel to outer #1 body bolts: 21-23/32".

F - Outer #1 body bolt to #3 body bolt: 77-25/64".

G - Height of top surface of front cross member at center of frame below normal top surface of side rail at front cross member: 5-15/16".

Dimensions for X and Y are not given, as they illustrate points for taking diagonal measurements for checking the squareness of the frame. Easily identifiable features of the frame are located at the approximate terminal points of the arrows and should be used in making these measurements.

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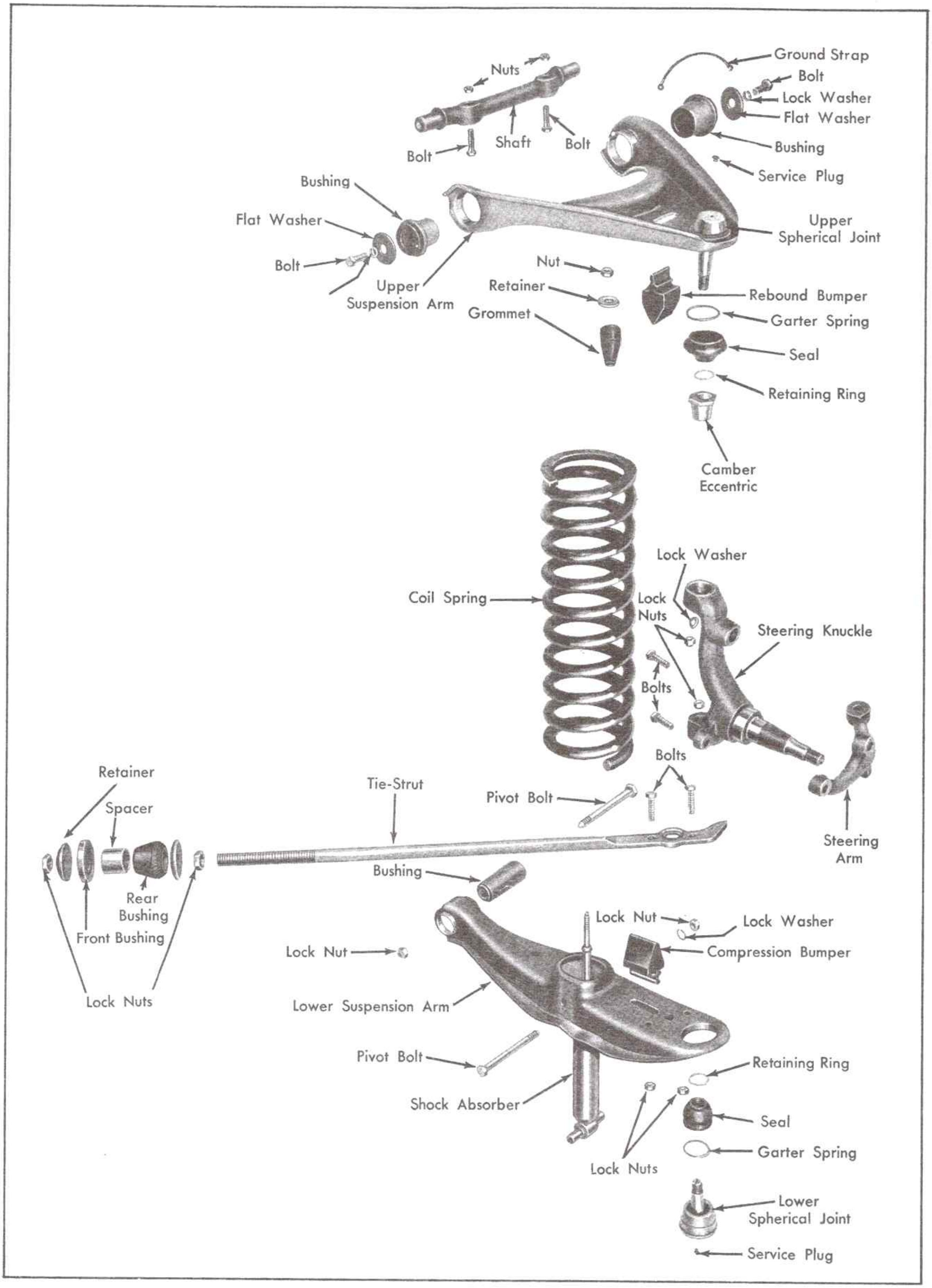


Fig. 3-1 Front Suspension - Disassembled

GENERAL DESCRIPTION

All 1967 Cadillac cars use an independent spring type front wheel suspension system. The front suspension system consists of two upper and lower control arm assemblies, steel coil springs, shock absorbers, front diagonal tie-struts, and a stabilizer bar, Fig. 3-1. Rubber bushings are used at all frame attaching points.

The front suspension system is designed so that the geometry of the upper and lower suspension arms produces an anti-dive reaction during braking.

The front suspension system used on the Fleetwood Eldorado is described on page 3-25.

Front Suspension System

a. Spherical Joints

Spherical joints are used at the outer ends of the upper and lower control arms. These joints are packed with lubricant and sealed at assembly and should not require further lubrication throughout their service life under normal driving conditions. The only maintenance they normally require is an inspection of the seals for physical damage each time the engine oil is changed.

Service plugs are provided in the spherical joint covers so that the joints may be packed in the event a seal should become damaged and require replacement. Both the seals and plugs are serviceable.

The upper spherical joint is pressed into the upper suspension arm and tack-welded to the arm at two points. It connects the upper suspension arm to the steering knuckle through a camber adjustment eccentric. Camber adjustment is made by turning this eccentric to move the steering knuckle in or out at the top. The lower spherical joint, a tension type joint, is pressed into the lower suspension arm. It connects the lower suspension arm to the steering knuckle.

The spherical joints are designed to allow both the up-and-down movement of the wheel due to road irregularities, and the pivoting movement that takes place as the wheels are turned while steering.

b. Compression and Rebound Bumpers

A rubber compression bumper on the lower suspension arm limits upward travel of the suspension system and a rubber rebound bumper on the upper suspension arm limits downward travel. Both bumpers are held in place by means of a pull-through tab.

c. Tie-Struts

Diagonal tie-struts are used on the front suspension system to control the fore and aft movement of the wheels. The struts are bolted to the outer ends of the lower suspension arms, just inboard of the spherical joints, and extend through the frame front cross member. Rubber bushings and a steel spacer are used at the frame mount.

The forward ends of the struts are threaded and secured to the frame cross member by bushing retainers and locknuts. Caster adjustments are made by adjusting the locknuts on the threaded ends of the struts.

d. Suspension Arms

The upper suspension arms pivot at their inner ends on two flanged rubber bushings, one at each end of the one-piece suspension arm shaft, which is bolted to the top surface of the spring tower on the front suspension frame cross member. The lower suspension arms pivot on a single rubber bushing that is bolted to the front suspension frame cross member.

The upper suspension arms and spherical joints are interchangeable, left and right, previous to being welded into an assembly. The lower suspension arms are not interchangeable but their spherical joints are interchangeable.

e. Steering Knuckle

The steering knuckle is mounted to the tapered spherical joint studs at the outer ends of the upper and lower suspension arms. The brake backing plate is bolted directly to the steering knuckle. At the upper end, attachment is through a fixed anchor pin. At the lower end, both the brake backing plate and steering arm are fastened to the steering knuckle by two bolts extending through the steering knuckle, steering arm, and brake backing plate.

The tie-struts, steering knuckles, and upper suspension arm shafts are interchangeable right and left, but the steering arms are not.

f. Stabilizer Bar

A front end stabilizer bar is used to provide steering stability and to control body roll. The stabilizer bar is mounted on the frame front side rails forward of the suspension arms and is connected to the lower suspension arms by steel

links that are cushioned at each end in rubber bushings. The stabilizer bar extends straight across the car between its frame mounts.

g. Springs and Standard Shock Absorbers

The front wheels are controlled in their up-and-down movement by steel coil springs and direct acting permanently sealed shock absorbers.

The springs are mounted with the lower ends seated on the lower suspension arms and the upper ends seated in towers on the front suspension frame cross member.

The standard shock absorbers incorporate a nylon skirted piston that provides a long-life bearing surface and uniform control of oil bleed around the piston. These shock absorbers provide efficient and constant damping control because oil is separated from air in the reservoir, which eliminates aeration of oil and prevents lag. Separation is accomplished by means of a pliacell envelope filled with an inert gas that takes the place of the air pocket.

The front shock absorbers are positioned in the center of the coil springs and are attached at the upper ends to the spring seat towers. The lower ends are attached to the lower suspension arms by pivot bolts that go through the arms and the lower shock mount sleeves.

SERVICE INFORMATION

1. Front Wheel Alignment

a. Sequence of Operations

Correct wheel alignment is necessary to keep the front wheels in their true running position, and to prevent tire wear and hard steering. Tire wear is affected, as far as front end alignment is concerned, by incorrect toe-in or excessive camber. Incorrect caster has little effect on tire wear.

Always check front wheel alignment whenever any front suspension part is removed and installed, or in cases of tire wear, or of driver complaint on handling.

The following operations should be performed in the order listed whenever front wheel alignment is checked and adjusted.

1. Check tire pressure.

2. Check adjustment of front wheel bearings, Section 10, Note 3a.

3. Check trueness and tracking of front and rear wheels.

4. Check front and rear standing heights, Note 2.

5. Check condition of spherical joint seals and all bushings, Note 11.

6. Check for looseness in steering gear and connections.

7. Check caster and camber, Notes 1c and 1d.

8. Check toe-in, Note 1e, and straight ahead position of steering wheel.

b. Measuring Methods

All wheel alignment equipment manufacturers provide detailed instructions for checking wheel alignment with their alignment equipment. These instructions should be carefully followed.

In addition to the manufacturer's instructions, be sure to observe the following recommendations:

1. Make sure that the car is at curb weight (full fuel tank, spare tire, jack, no passengers).

2. Inflate tires to proper pressure.

3. Raise front end of car and check runout of each tire. Mark the spot where maximum runout occurs.

4. Place the maximum runout either to the front or rear. (This neutralizes the effect of runout on caster or camber). Lower front end of car.

5. Move bumper up and down to normalize the front spring height.

6. Check caster and camber, Fig. 3-2.

c. Caster Adjustment

Caster is adjusted by turning the locknuts on the forward ends of the tie-struts at the frame front cross member, Fig. 3-3. Adjustment is made from under car.

Caster should be -1/2° to 1-1/2° on all series cars with a preferred setting of -1°. Caster variation between wheels must not exceed 1/2°.

Proper caster adjustment is obtained by shortening or lengthening the tie-struts between lower

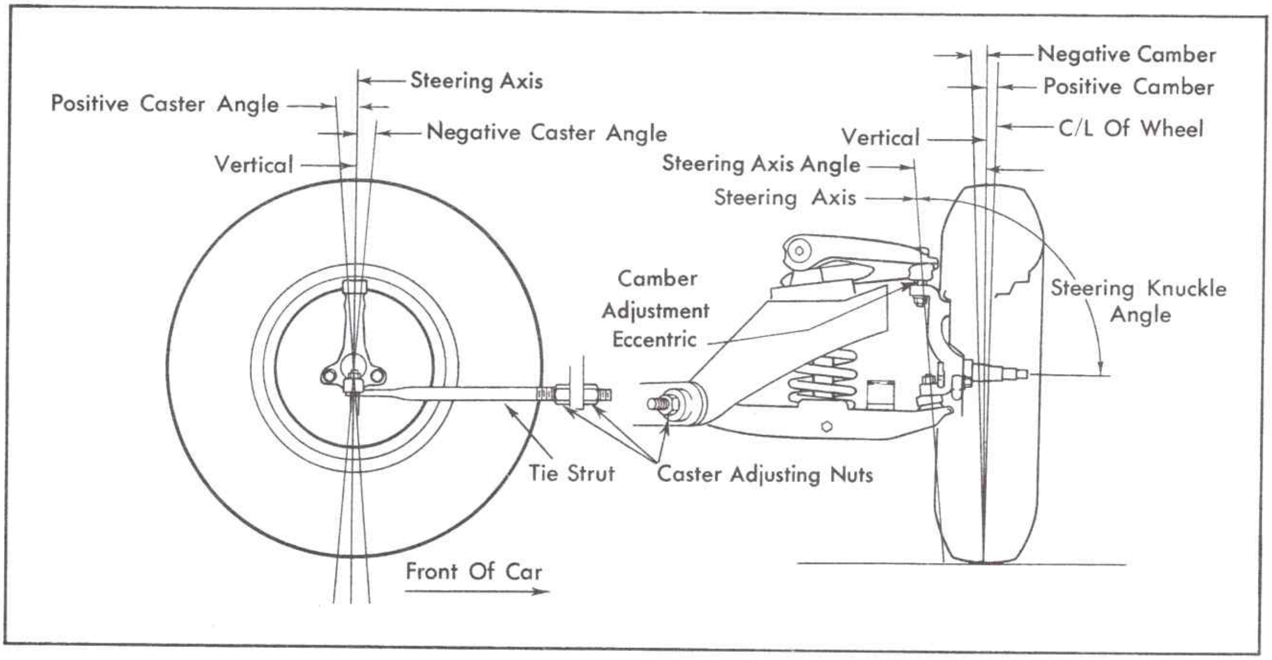


Fig. 3-2 Elements of Front Wheel Alignment

suspension arms and frame front cross member, to tilt vertical axis of wheel either "fore" or "aft".

Before adjusting caster, loosen tie-struts at lower suspension arms. This will allow tie-strut to center itself and prevent damage to bushings and premature wear at frame front cross member.

To provide more negative caster, lengthen tie-struts by loosening front locknuts and tightening rear locknuts. One turn of locknuts results in approximately 1/2° change in caster.

To provide more positive caster, shorten tie-struts by loosening rear locknuts and tightening front locknuts.

After proper caster adjustment has been made, tighten tie-strut mounting bolt nuts at lower arms to 55 foot-pounds, and front locknuts to 35 foot-pounds, Fig. 3-3. Recheck to make sure adjustment is correct after locknuts have been tightened.

d. Camber Adjustment

Camber is adjusted at the camber eccentric located in steering knuckle upper support, Fig. 3-4. The upper spherical joint stud fits through the camber eccentric and the knuckle. Turning camber eccentric moves the steering knuckle in or out at the top.

To adjust camber, loosen locknut on spherical joint stud one turn and tap bottom of stud with

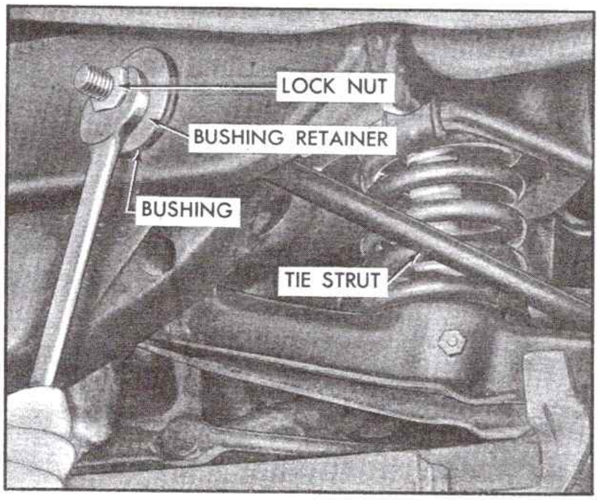


Fig. 3-3 Adjusting Caster

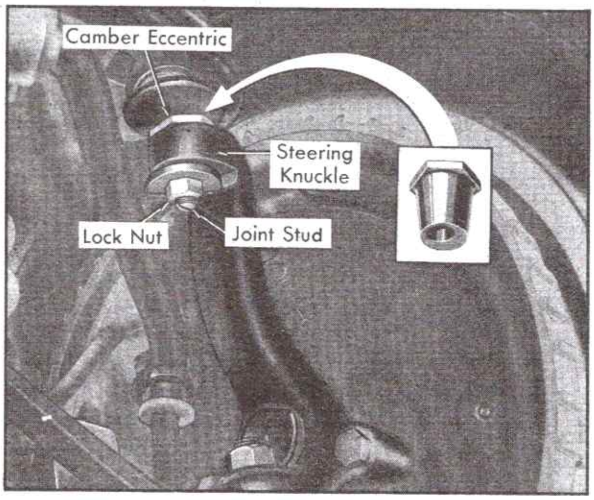


Fig. 3-4 Camber Adjustment Eccentric

soft mallet to free camber eccentric in knuckle. If camber eccentric will not break loose, install a standard nut halfway on end of stud. Make certain that locknut is loose, then insert a 7/16 inch diameter steel rod, approximately 20 inches long, inside nut so that it rests against stud. Strike rod with a heavy hammer, Fig. 3-5, to break camber eccentric loose.

Using Camber Adjusting Wrench, J-9231, Fig. 3-6, turn camber eccentric until +3/8° to -1/8° camber is obtained on left wheel and +1/8° to -3/8° camber is obtained on right wheel. Preferred setting is 0° on left, -1/4° on right. Left wheel must have 1/4° to 1/2° more positive camber than right wheel to compensate for crowned roads. Final position of joint stud should be in rear portion of camber eccentric in order to keep steering arm angle correct. Tighten locknut on spherical joint stud to 60 foot-pounds.

The following chart indicates acceptable combinations for adjusting front wheel camber.

Left Wheel Camber	Acceptable Variation in Right Wheel Camber
+3/8°	+1/8° to -1/8°
+1/4°	0° to -1/4°
+1/8°	-1/8° to -3/8°
0°	-1/4° to -3/8°
-1/8°	-3/8°
Preferred For Service - Left Wheel 0°, Right Wheel -1/4°	

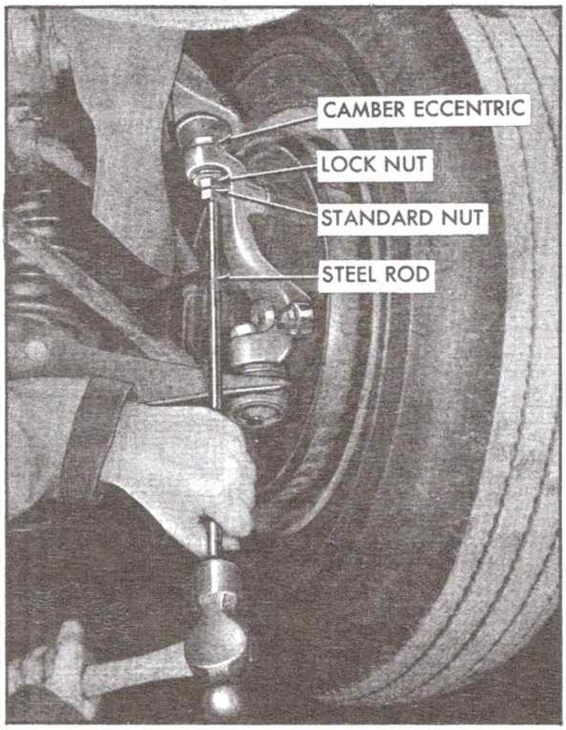


Fig. 3-5 Loosening Camber Eccentric

e. Toe-In Adjustment

The setting or adjustment of the front wheels where the distance between them is less at the front of the tire than at the rear is called "toe-in". The purpose of toe-in is to counteract the forces that tend to make the front wheels toe out while the car is traveling forward.

Toe-in should be measured in accordance with instructions provided by the wheel alignment equipment manufacturer.

Before checking toe-in, make certain that drag link height is correct. See Section 9, Note 6. The readings should be taken only when the front wheels are in a straight ahead position and with steering gear on its high spot. The correct setting should be between 3/16 inch and 1/4 inch.

Toe-in is adjusted by turning the tie rod adjuster tubes at outer ends of each tie rod after loosening clamp bolts.

CAUTION: Do not use a pipe wrench or heavy tool to free tie rod adjuster tubes if they are seized, rusted or corroded. If necessary, use penetrating oil or pry tie rod adjuster tubes open with a flat bladed tool. Replace tie rod, adjuster tubes, or tie rod outer pivots if damaged. The tie rod adjuster tubes should be lubricated with chassis lubricant if disassembled from tie rods for any reason. When turning adjuster tubes, be careful not to turn tie rod ends so that they bottom out, as seals could get pinched between stud and socket and become damaged. If this happens the entire pivot must be replaced.

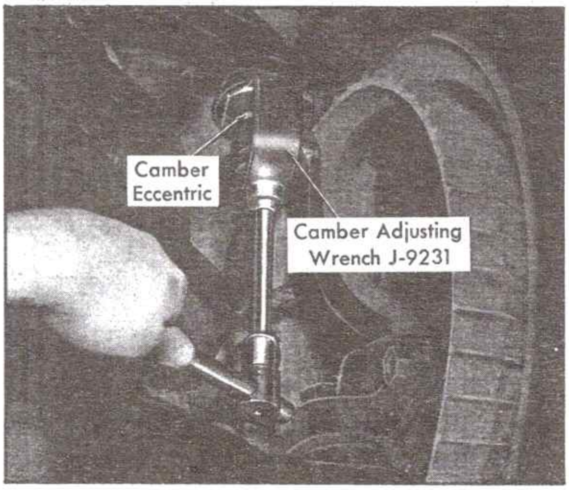


Fig. 3-6 Adjusting Camber

Be sure to turn both adjuster tubes an equal amount when adjusting toe-in so that relation of steering gear high spot to straight ahead position of front wheels will not be changed. (Both left and right pivot ends have left hand threads).

When adjustment has been completed, according to recommended specifications, tighten nuts on clamp bolts to 20 foot-pounds.

NOTE: Be sure that open sides of clamps are pointed downward within 45° of vertical to prevent possible interference with the frame on maximum compression. Both the tie rod ends and joint studs should be in a centralized position before tightening clamps. Check relationship between jaws of clamp and slot in adjuster tube. Do not allow a corner of one to catch on a corner of the other, Fig. 3-7. Turn clamp until corners clear each other, but do not rotate it more than 45° from straight down.

Each tie rod should be checked after adjustment by grasping the center of the tie rod and moving it up and down. The movement should be equal in both directions; if not, it is an indication that the pivot studs are not properly positioned. If tie rods are not properly positioned, a binding condition may occur, resulting in poor return of wheels to straight ahead position. Also check steering linkage joints for looseness. Replace inner or outer tie rod pivot if loose.

Make certain that steering wheel is centered after toe-in adjustment has been made. If necessary, readjust toe-in to center steering wheel.

2. Checking Front Standing Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack, and that there is a full tank of gasoline, as all specifications are based on this curb weight. Normalize position of springs by bouncing bumper up and down; release bumper and permit car to assume its normal position.

a. Front Springs

Measure the distance from the top of the lower control link in front of the rubber bumper to the flat surface on the bottom of the frame. Standing heights should be equal on both sides of car within 3/8 inch. If heights are unequal, it will be necessary to replace the spring on the low side.

See Page 4-19 for specifications for each series.

b. Ride Complaints

In case of hard riding, the first items to investigate are correct tire pressure, correct standing heights, and correct shock absorbers for the car. If these are correct, the amount of friction in the front suspension system should be checked.

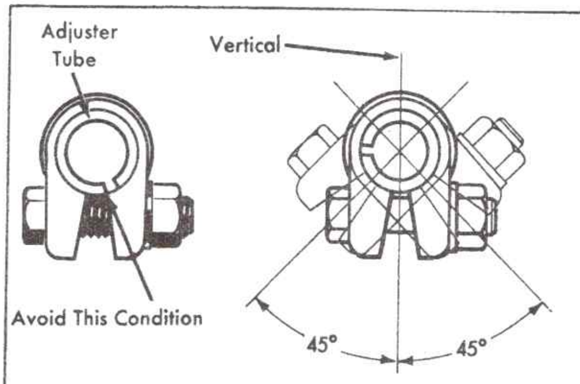


Fig. 3-7 Tie Rod Clamp Position

The procedure for checking excessive friction in the front suspension is as follows:

1. Disconnect front shock absorbers.

2. With aid of a helper, lift up on the front bumper and raise the front end of the car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from the floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height; again take measurement at same point on bumper.

If the difference between these two measurements is 1-1/4 inch or more, it indicates excessive friction in the suspension system. Probable causes could be damaged seals on the spherical joints permitting dirt and water in the joints, or bound up steering linkage.

3. Front Shock Absorbers

a. Removal

1. Raise hood and remove shock absorber upper retaining nut and retainer at upper suspension arm frame mounting bracket. The shock absorber upper stem is square at the top so that it may be held by a wrench to prevent stem from turning when removing nut.

2. Remove bolt holding lower end of shock absorber to lower suspension arm.

3. Remove shock absorber through bottom of lower arm.

b. Installation

1. If new grommet is required, apply a small amount of silicone lubricant to grommet and force grommet through frame hole with a twisting motion.

2. Install retainer on shock absorber upper stem, and fully extend shock absorber rod.

3. Insert shock absorber assembly up into coil spring and guide stem through grommet. Then place lower end in position on lower suspension arm, and install bolt, lockwasher, and nut. Tighten nut to 40 foot-pounds.

4. Install retainer and nut on shock absorber upper stem, and tighten nut, holding stem from turning with wrench.

4. Checking Front Shock Absorbers

a. On Car Checks

1. Raise car on hoist.

2. Check for correct mounting of shock absorbers. If properly mounted, remove front shock absorbers from car.

3. Extend shock absorber and check to see if piston rod and seal (top of shock) cover is wet with a fresh film of oil. If oil is detected, check for a leak in the power steering hose, transmission cooler lines, etc.

4. If no oil is detected, pump shock absorber up and down by hand as fast as possible. If a skip is felt at end of stroke, proceed to bench check.

5. As another check, completely extend shock absorber and pull hard. If spring tension is felt, shock absorber should be replaced.

IMPORTANT: Pumping shock absorber by hand will not determine whether or not a shock absorber is good or bad. The best test method is to compare the questionable shock absorber with its mate on opposite side of car. If both front shocks feel the same, it is unlikely that a shock absorber replacement is necessary.

b. On Bench Checks

1. When performing a bench check for any suspected defective shock absorber, clamp shock absorber upside down in a vise.

NOTE: Cadillac shock absorbers can be turned upside down because all internal vapor (inert gas instead of air) is contained in a pliacell envelope which prevents aeration of oil and prevents lag.

2. Pump shock absorber by hand at various rates of speed to find if shock absorber is defective. If a skip is felt at full extension when the shock is inverted, this is normal. A skip on reversal of direction in mid-travel indicates a ruptured pliacell envelope. If, however, smooth resistance is felt throughout length of the stroke, the shock absorber need not be replaced. A faint hiss ("orifice swish") is considered normal, but a gurgling noise denotes air bubbles in the fluid, and the shock absorber should be replaced.

5. Stabilizer Bar

a. Removal

1. Remove nut, retainer, and grommet from bottom of each link, Fig. 3-8.

2. Remove bolts from mounting brackets that hold stabilizer to frame, and remove brackets and stabilizer.

3. Remove rubber bushings from stabilizer bar, and remove grommets, retainers, spacers, and links from ends of stabilizer bar.

b. Installation

1. Position stabilizer bar under front frame side rails and slide rubber bushings in place.

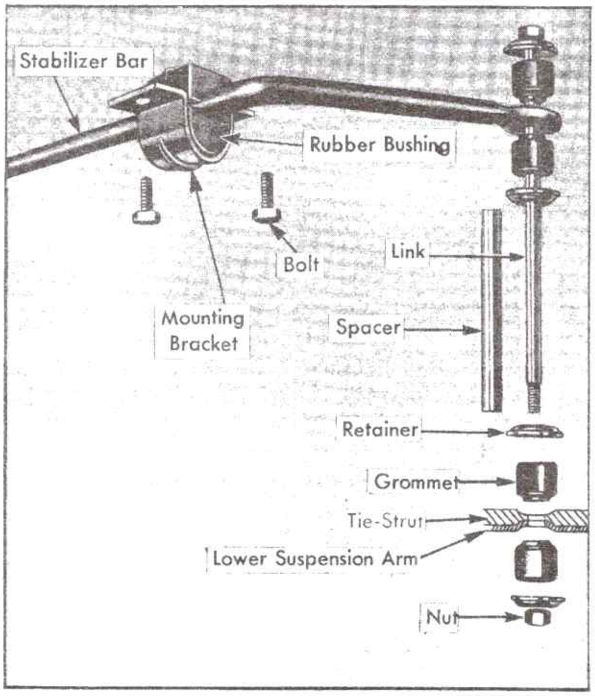


Fig. 3-8 Front Stabilizer Linkage

2. Install mounting brackets over rubber bushings and secure with bolts, Fig. 3-8. Tighten bolts to 20 foot-pounds.

3. Install grommets, retainers, links, and spacers on ends of stabilizer bar, making certain that retainers and grommets are arranged exactly as shown in Fig. 3-8.

4. Install grommet, retainer, and nut on bottom of each link. Tighten nut to end of threads.

6. Tie-Strut and Bushings

a. Removal

1. Raise front end of car and place jack stands under frame.

2. Disconnect stabilizer link from lower arm on side from which tie-strut is to be removed.

3. Remove locknut, bushing retainer, and bushing from forward end of tie-strut, Fig. 3-9.

4. Remove two bolts securing tie-strut to lower suspension arm and remove strut.

5. Remove rear bushing, spacer, and retainer from tie-strut.

6. Remove rear locknut from tie-strut if necessary.

NOTE: If replacing only bushings, do not disturb rear locknut on tie-strut, otherwise it will be necessary to readjust caster and camber.

b. Installation

1. If rear locknut was previously removed, install a new locknut (3/4 inch thick) on threaded end of tie-strut, and run nut approximately 3/4 inch from end of thread.

2. Install rear bushing retainer on tie-strut with concave side against nut.

3. Insert metal spacer part way through conical shaped bushing from small end and install on tie-strut with small end toward front of car.

4. With tie-strut held in a horizontal position, install threaded end through frame front cross member.

5. Position opposite end of tie-strut on lower suspension arm with pointed end pointing inward and install two attaching bolts and nuts loosely.

6. Install front bushing on end of tie-strut,

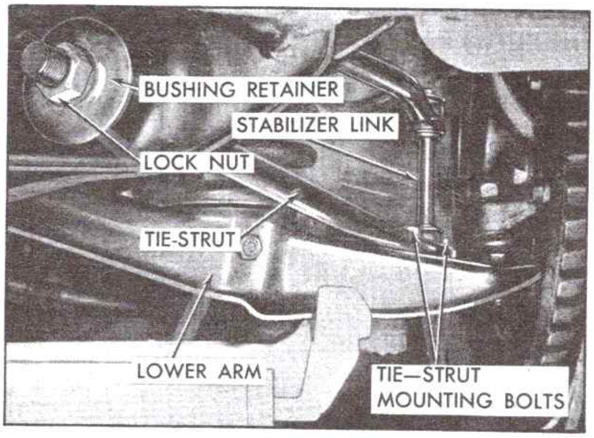


Fig. 3-9 Front Suspension Tie Strut

cupped side toward frame, and slide bushing against frame cross member.

7. Install front bushing retainer on tie-strut with concave side against bushing, Fig. 3-9.

8. Start new locknut (5/8 inch thick) on threaded end of tie-strut.

9. Connect stabilizer link to lower suspension arm. Make certain that grommets and retainers are installed properly.

10. Lower car, and with car weight on all four wheels, position front bushing on metal spacer and tighten locknut on front end of tie-strut to 35 foot-pounds.

11. Tighten tie-strut to lower arm attaching bolt nuts to 55 foot-pounds.

12. If rear locknut was disturbed during tie-strut removal or installation, adjust caster and camber as described in Notes 1c and 1d.

7. Front Upper Suspension Arm Spherical Joint Seal Replacement (On Car)

1. Raise front end of car and place jack stands under lower suspension arms so that shock absorber lower mounts rest on jack stands.

2. Remove wheel and tire assembly.

3. Remove locknut and special flat washer from spherical joint stud.

4. Scribe a mark on camber eccentric and steering knuckle to facilitate alignment at time of installation.

5. Remove joint from knuckle, using a 7/16 inch steel rod approximately 20 inches long, rounded on one end. Install a standard nut part

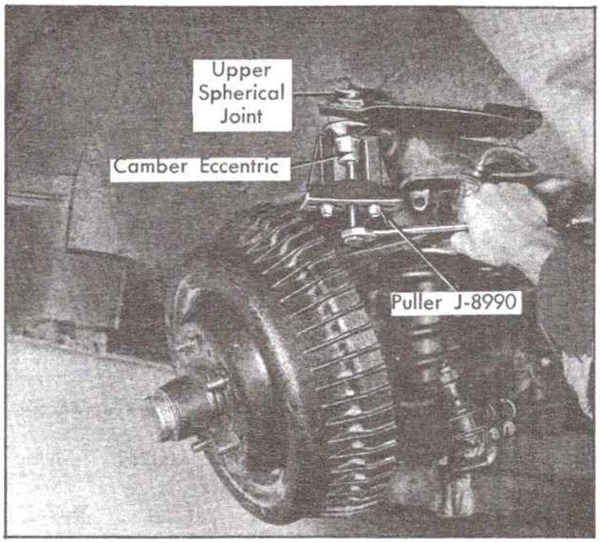


Fig. 3-10 Removing Camber Eccentric

way on stud and insert rounded end of rod inside nut. Strike end of rod with a heavy hammer until joint is free from steering knuckle, then remove standard nut.

6. Raise up on upper arm and remove spherical joint from steering knuckle.

7. Remove camber eccentric from joint stud, using Puller, J-8990, Fig. 3-10.

NOTE: In cases where camber eccentric is seized or "frozen" to joint stud, remove upper suspension arm assembly, and remove camber eccentric as a bench operation.

8. Wipe outer seal surface clean to prevent any dirt from lodging in joint pivot when seal is removed.

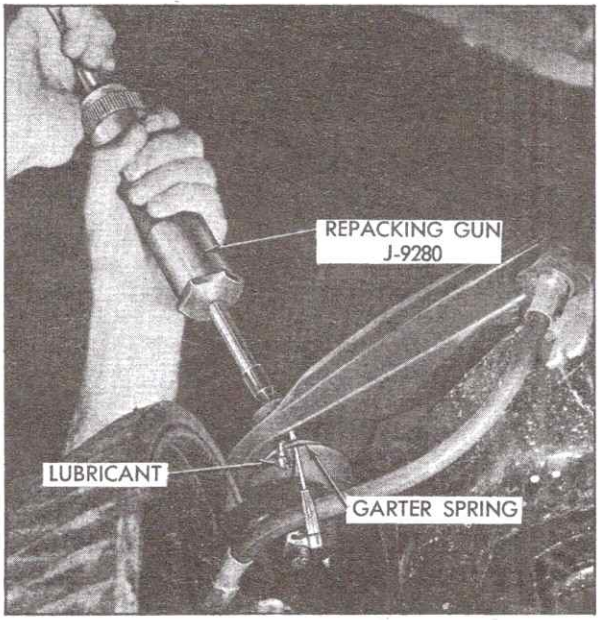


Fig. 3-11 Repacking Front Upper Spherical Joint Seal

9. Remove garter spring from top of seal and remove and discard seal and spring.

10. Clean joint pivot and stud thoroughly, removing all old grease and any dirt accumulation.

11. Inspect ball pivot for looseness or binding, Note 11a. Joint should turn in its socket at 2 to 4 foot-pounds. If spherical joint is damaged or worn, replace joint and arm as an assembly.

12. Pry out service plug from spherical joint cover and discard plug.

13. Using Repacking Gun, J-9280, and Fitting, J-9280-5, apply lubricant until approximately two teaspoons of lubricant escapes under the seal at the screwdriver, Fig. 3-11. Any water trapped in the joint should be forced out by the fresh lubricant.

CAUTION: Make certain that proper type lubricant is used when repacking suspension joints, as use of any other lubricant will contribute to premature failure.

14. Install new service plug in spherical joint cover.

15. Install new seal on spherical joint. Proceed as follows:

a. Compress seal on flat surface to pucker small hole of seal.

b. Place nylon ring over center of puckered hole, Fig. 3-12.

c. Press in on underside of seal, and press nylon ring until nylon ring seats itself in groove around hole. Continue to press seal until it assumes normal shape.

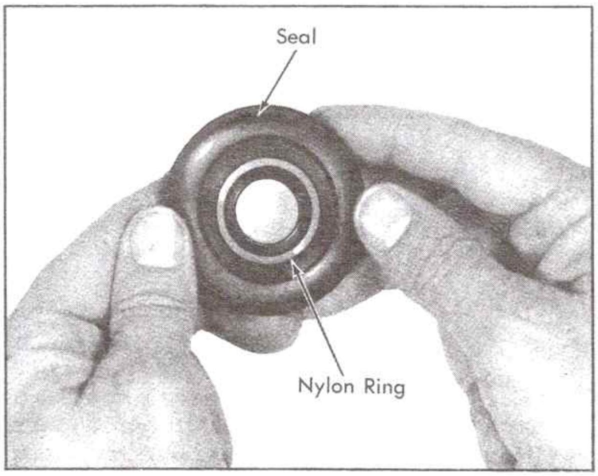


Fig. 3-12 Installing Nylon Ring on Seal

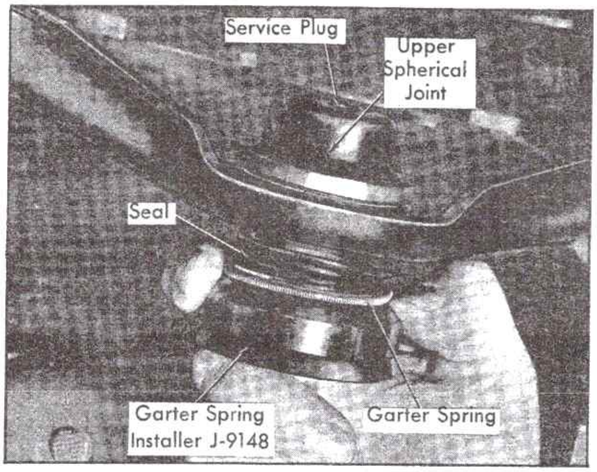


Fig. 3-13 Installing Spring on Upper Spherical Joint Seal

d. Apply a small amount of lubricant around hole in seal. Wipe groove in joint housing clean and install seal on joint stud. Make certain that large groove diameter of seal engages in recess (circular groove) around joint housing.

e. Allow air to enter seal by momentarily prying large lip of seal away from joint housing with a small screwdriver.

f. Grasp small end of seal and extend toward threaded end of stud.

g. Install new garter spring on the smaller flanged surface of Spring Installer, J-9148, and lubricate inside diameter of installer with suspension lubricant.

h. Install spring on seal using Garter Spring Installer, J-9148, Fig. 3-13. Make certain that spring secures lip of seal in recess all around joint housing.

NOTE: If spring should separate where it is joined together, it is not an indication that the spring is broken. Join spring ends together and lock by twisting male end counterclockwise approximately 2-3 turns. Ends will thread into each other upon releasing.

16. Apply a light coating of grease on outside taper of camber eccentric and install camber eccentric on joint stud.

17. Thoroughly clean inside of steering knuckle and install joint stud and camber eccentric in steering knuckle, remembering to align scribe marks on eccentric and knuckle.

18. Install standard nut on joint stud and tighten nut until camber eccentric locks in knuckle; then remove standard nut and install special flat washer and new locknut, tightening to 60 foot-pounds.

19. Install wheel assembly, remove jack stands and lower car.

20. Check camber and adjust if necessary as described in Note 1d.

8. Repacking Front Lower Suspension Arm Spherical Joint Seal

1. Raise car.

2. Clean off all road deposits from affected lower spherical joint seal and remove plug at bottom of joint housing.

3. Using Repacking Gun, J-9280, and fitting, J-9280-5, apply lubricant until grease is forced out between upper end of seal and knuckle, Fig. 3-14. Any water trapped in the joint should be forced out by the fresh lubricant.

NOTE: After removing repacking gun, allow 8 to 12 inches of lubricant to escape through fitting to relieve seal pressure before installing plug.

4. Install new rubber plug.

5. Inspect seal for cuts, chafes, or pin holes. Escape of lubricant from any place other than top of seal indicates a damaged seal that should be replaced.

6. Repeat steps 2 through 5 on opposite side of car.

7. Lower car.

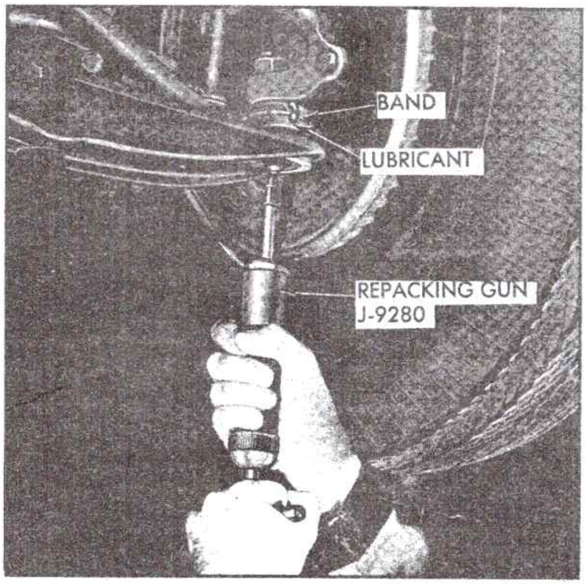


Fig. 3-14 Repacking Front Lower Spherical Joint Seal

9. Front Lower Suspension Arm Spherical Joint Seal Replacement (On Car)

1. Raise front end of car and place jack stands under lower suspension arms approximately 2 inches inboard of spherical joints.

CAUTION: Jack stands must be used to prevent lower arm from swinging down when locknut is removed from joint stud.

2. Remove wheel assembly.

3. Remove locknut from lower spherical joint stud and install a standard nut on joint stud, running nut to within two threads of steering knuckle support. This nut will prevent lower arm from dropping down when joint stud is broken free of steering knuckle.

4. Raise front end of car slightly off jack stands with hydraulic jack.

5. Strike steering knuckle with a heavy hammer in area of spherical joint stud to break stud loose.

6. Lower car on jack stands, being certain that rebound bumper on upper arm clears frame, and remove standard nut from joint stud.

7. Raise up on upper arm and remove steering knuckle from lower joint stud.

8. Wipe outer seal surface clean to prevent any dirt from lodging in joint pivot when seal is removed.

9. Pry copper band off bottom of seal. Remove and discard seal and band.

10. Clean joint pivot and stud thoroughly, removing all old grease and any dirt accumulation.

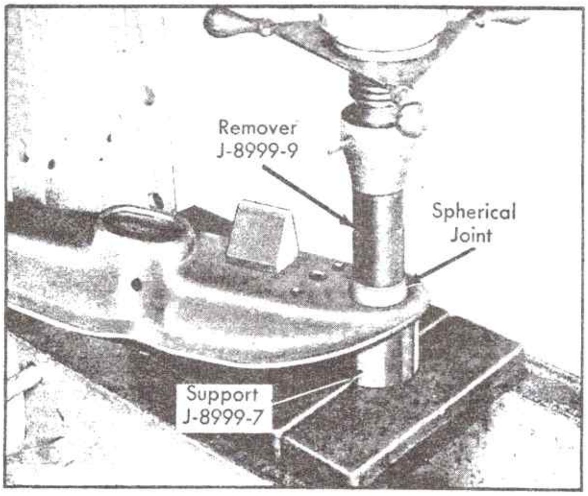


Fig. 3-15 Removing Spherical Joint from Lower Arm

11. Inspect ball pivot for looseness or binding, Note 11b. Free play should not exceed 1/16 inch as the joint operates vertically in its socket. Replace joint if it exceeds this limit.

12. Pry service plug from spherical joint and discard plug.

13. Using Repacking Gun, J-9280, and Fitting, J-9280-5, repack joint through plug hole with lubricant. Force lubricant into joint until enough comes through to flush out any moisture and foreign material. Usually one or two ounces will be needed. Wipe off surplus.

CAUTION: Be certain that only suspension lubricant is used.

14. Install new seal on spherical joint and secure band.

CAUTION: Spherical joint housing at point of seal contact must be completely dirt and grease free to insure a good seal when band is installed.

15. Install new service plug.

16. Guide spherical joint stud into steering knuckle support.

17. Install standard nut on joint stud and tighten nut until joint stud seats in steering knuckle support.

18. Remove standard nut and install locknut on joint stud, tightening to 65 foot-pounds.

NOTE: A large quantity of grease will purge from the upper end of joint because seal volume is reduced when installed in steering knuckle.

19. Install wheel assembly and adjust wheel bearings as described in Section 10, Note 3a.

20. Replace wheel disc, remove jack stands and lower car.

10. Front Lower Suspension Arm Spherical Joint

a. Removal

1. Remove lower suspension arm and coil spring as described in Note 14a.

2. Remove band and seal from spherical joint.

3. Using an arbor press, position Support, J-8999-7, on press anvil and place lower arm on Support with spherical joint cover resting in Support.

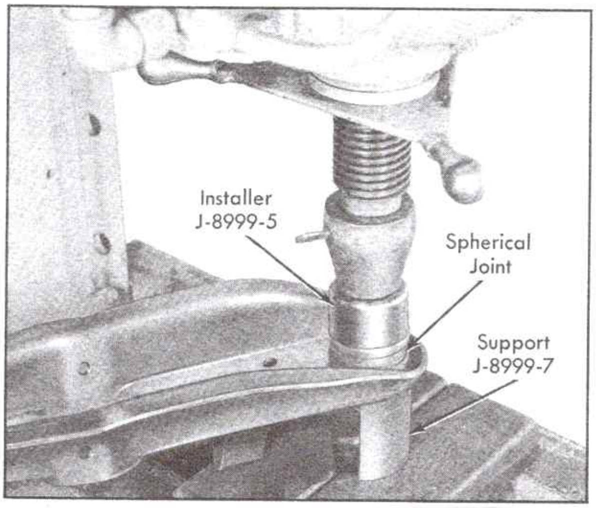


Fig. 3-16 Installing Spherical Joint in Lower Arm

4. Position Spherical Joint Remover, J-8999-9, over joint stud until it seats on joint housing, Fig. 3-15, and press spherical joint out of arm.

b. Installation

1. Using an arbor press, position Support, J-8999-7, on press anvil and place lower arm on Support, bottom side up, so that spherical joint mounting hole is encompassed by support.

2. Insert new spherical joint in arm, stud end first, aligning joint housing with mounting hole.

3. Position Spherical Joint Installer, J-8999-5, on flanged portion of joint housing, Fig. 3-16, and press spherical joint into arm until joint flange bottoms on mounting hole flange.

4. Install lower suspension arm and coil spring as described in Note 14b.

11. Front Suspension Spherical Joint Checking Procedure

If spherical joints show signs of looseness or wear, they should be checked by following procedure after first disconnecting ball stud from steering knuckle.

a. Upper Spherical Joint

Using regular spherical joint stud nut and a second nut as a locknut, turn joint in its socket with a torque wrench. It should read 2-4 foot-pounds. Replace a joint that is too loose or too tight.

b. Lower Spherical Joint

The lower spherical joint is designed to turn freely in its socket and cannot be checked with a torque wrench. It should be checked by noting amount of free play as joint is worked vertically in its socket. Free play should not exceed 1/16 inch. Replace joint if it exceeds this limit.

NOTE: If joints are to be cleaned, use a clean cloth only. Do not use solvent.

12. Front Upper Suspension Arm

a. Removal

1. Raise front end of car, place jack stands under lower suspension arms and remove wheel.

2. Remove locknut and special flat washer from upper spherical joint stud.

3. Remove joint from knuckle using a 7/16 inch steel rod approximately 20 inches long, rounded on one end. Thread a standard nut part way on stud and insert rounded end of rod inside nut. Then, using a heavy hammer, strike end of rod until joint is free from steering knuckle, Fig. 3-5.

4. Remove locknuts and shaft mounting bolts at frame tower, Fig. 3-17, and remove upper suspension arm and shaft assembly.

5. Remove bolt, lockwasher, and flat washer from each end of shaft and remove ground strap.

6. Camber eccentric may be removed from spherical joint stud if necessary, by using Puller, J-8990.

NOTE: Do not attempt to remove spherical joint from upper suspension arm. Since it is welded to arm, any rewelding could damage joint seal or weaken arm. The upper arm and spherical joint are serviced as an assembly.

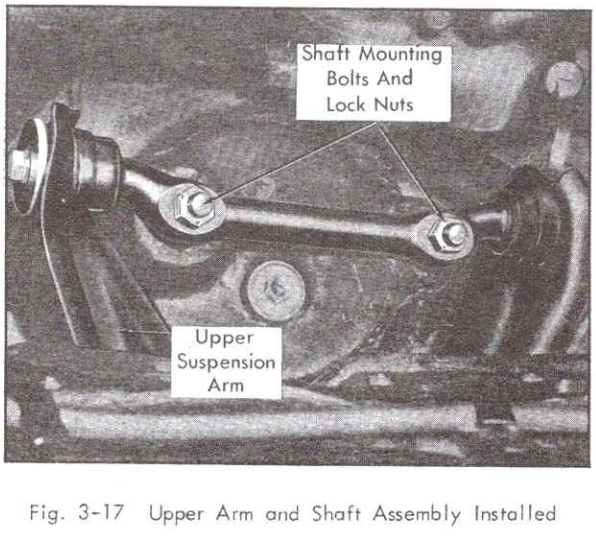


Fig. 3-17 Upper Arm and Shaft Assembly Installed

b. Installation

1. Position upper arm assembly on frame tower and install mounting bolts and locknuts, Fig. 3-17. Tighten nuts to 60 foot-pounds.

NOTE: It may be necessary to remove or temporarily reposition generator in order to apply torque wrench to locknuts on right side of car.

2. Install camber eccentric on joint stud if previously removed.

3. Guide joint stud and camber eccentric into upper end of knuckle and install a standard nut on end of joint stud.

4. Tighten nut until camber eccentric locks in knuckle; then remove standard nut and install special flat washer and locknut. Tighten nut to 60 foot-pounds.

5. Install wheel and lower car.

6. Install ground strap on one end of arm.

7. Install flat washer, lockwasher and shaft attaching bolt on each end of shaft, securing ground strap under bolt head. Tighten bolts to 60 foot-pounds.

8. Check wheel alignment and adjust if necessary.

13. Front Upper Suspension Arm Shaft and Bushings

It will be necessary to make two spacers from cold rolled steel or similar material to facilitate removal of bushings from shaft. Dimensions of the spacers are shown in Fig. 3-18. Also provide two 1/2 inch x 2 inch bolts with nuts to hold spacers in position around shaft.

a. Removal

1. Remove bolt, lockwasher, and flat washer from each end of shaft and remove ground strap.

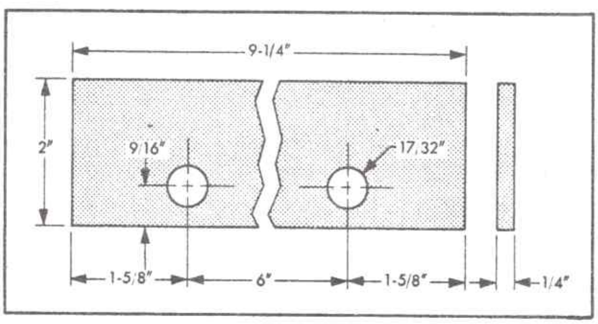


Fig. 3-18 Bushing Remover Spacer

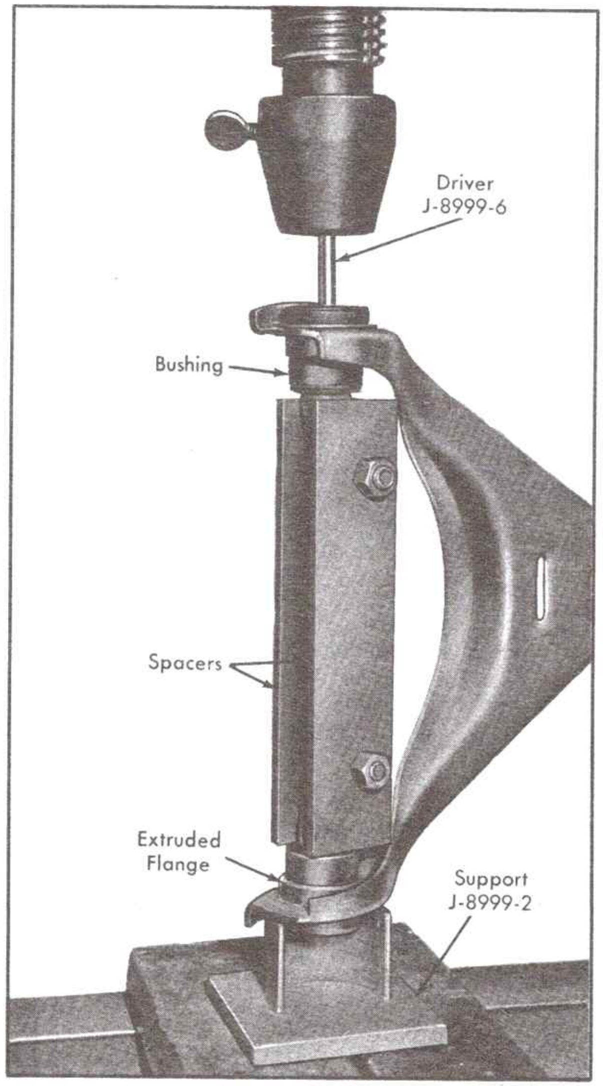


Fig. 3-19 Removing Bushing from Upper Arm

2. Install spacers on shaft between arm ends. Secure spacers to shaft with bolts and nuts, Fig. 3-19.

3. Apply a liberal amount of penetrating oil between bushing sleeve and arm.

4. Position Support, J-8999-2, on anvil of arbor press and place one end of arm on support with outer end of bushing resting in support.

5. Insert Driver, J-8999-6, through bushing in opposite arm and thread Driver into end of shaft.

6. Drive shaft downward until spacer plates touch extruded flanges of control arm, Fig. 3-19.

7. Remove arm assembly from arbor press. Remove Driver, insert on opposite end, and repeat steps 4 and 5.

8. Remove arm assembly from arbor press and remove Driver.

If necessary, tap end of bushing with hammer to complete its removal. Also tap in opposite direction to complete shaft removal from suspension arm.

9. Place end of shaft in vise with sleeve extending above vise jaws. Then place a bolt or drift pin against inner side of sleeve and hammer sideways, expanding split sleeve to aid in removal.

10. Remove remaining bushing either by driving out in vise, or by pressing out in arbor press.

11. Remove remaining sleeve in same manner.

12. Remove spacers from shaft.

b. Installation

1. Position Bushing Installer, J-8999-16 (part of Bushing Installer Set, J-8999-15), on arbor press anvil.

2. Insert bushing in one end of arm and place arm and bushing on Bushing Installer, with outer end of bushing seated in Installer, Fig. 3-20.

3. Place shaft between arm ends, aligning end of shaft with bushing inner sleeve.

4. Position bushing on opposite end of shaft, and place the other Bushing Installer, J-8999-16, on top of bushing. Hold assembly in place by exerting slight pressure on arbor press, Fig. 3-20.

5. Check alignment of bushings, arm ends, and shaft.

6. Install Spacer, J-8999-1, around shaft between arm ends to prevent arms from collapsing when bushings are installed.

7. Using arbor press, press bushing onto shaft until both bushing flanges bottom on arms.

NOTE: It is possible that both bushing inner sleeves may not butt flush against shaft shoulder. However, when bushing attaching bolts are tightened, bushing inner sleeves will seat themselves.

8. Remove arm assembly and installer tools from arbor press, and remove spacer tool.

9. Install ground strap on one end of arm.

10. Install flat washer, lockwasher, and bolt on each end of shaft, securing ground strap under bolt head.

NOTE: Do not torque bolts until arm assembly is installed on car. Proper torque for these bolts is 60 foot-pounds with car on ground.

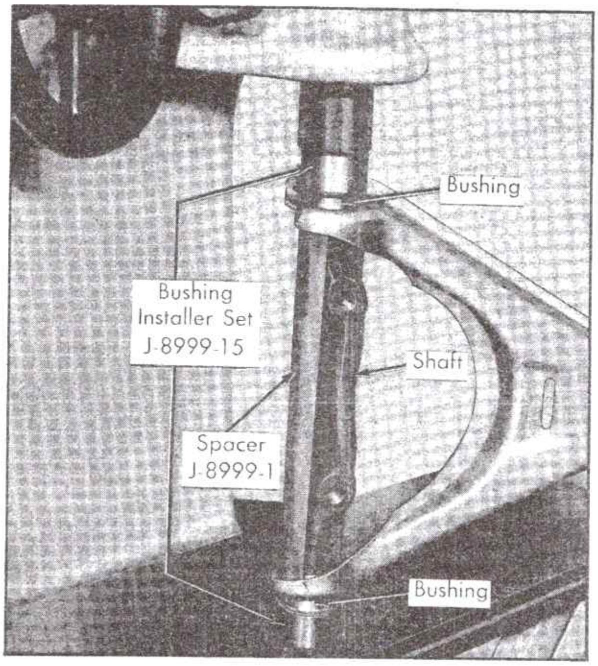


Fig. 3-20 Installing Shaft and Bushing in Upper Arm

14. Front Lower Suspension Arm and Coil Spring

a. Removal

1. Disconnect front shock absorber at its upper mount.

2. Raise front end of car and place jack stands under front frame side rails.

3. Disconnect stabilizer link from lower arm that is to be removed.

4. Disconnect tie-strut at lower arm.

5. Remove bolt securing shock absorber to lower arm and remove shock absorber.

6. Remove wheel assembly.

7. Remove nut from pivot bolt in lower arm at frame mount.

8. Position hydraulic jack under outboard end of lower suspension arm so that jack is supporting arm.

9. Remove locknut from lower spherical joint stud. Install standard nut on joint stud and run nut to within two threads of knuckle.

NOTE: Nut will prevent lower arm from

dropping when joint stud is broken free of steering knuckle.

10. Strike knuckle with a hammer in area of spherical joint stud to break joint loose. To facilitate removal of joint stud from knuckle, raise opposite rear corner of car to help compress spring.

11. Use jack to lift spring load from nut and remove nut from joint stud.

12. Slowly lower jack and remove spring.

13. Remove pivot bolt from lower arm at frame mount and remove arm.

b. Installation

1. Position inboard end of lower arm in frame mount and install pivot bolt. Do not install nut at this time.

2. Install end of spring in upper seat of frame. If working with left spring, rotate spring until end is flush with front of lower control arm, Fig. 3-21. If working with right spring, end should be flush with rear of right control arm.

NOTE: Raised edge on top of arm faces front of car on right side and rear of car on left side.

3. With aid of a helper and with jack placed under lower arm, Fig. 3-22, raise arm into position. Spring may have a tendency to rotate as arm is raised, mispositioning spring. Top of spring must seat within the five depressions on frame tower, and bottom end must be flush to one inch back of the front of left lower arm, or flush to one inch forward of the back of right lower arm.

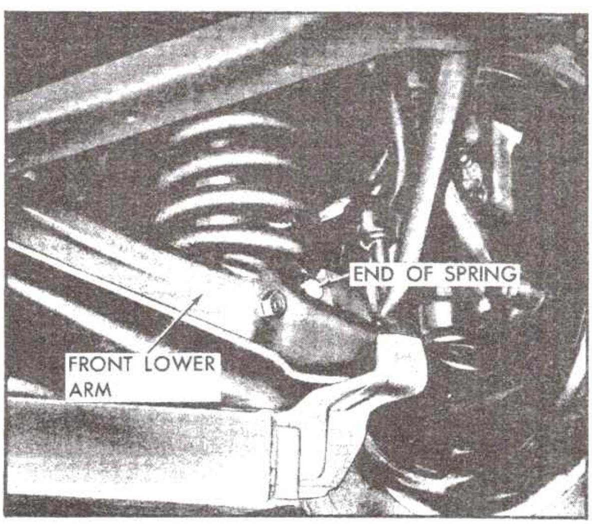


Fig. 3-21 Locating End of Spring

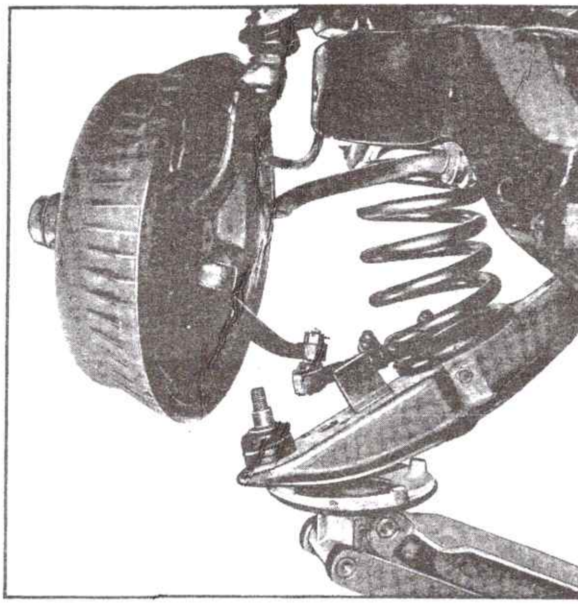


Fig. 3-22 Coil Spring Installation

4. Guide spherical joint stud into steering knuckle.

5. Install standard nut on joint stud and tighten nut until joint stud seats in knuckle.

6. Remove standard nut and install locknut on joint stud, tightening to 65 foot-pounds.

7. Install nut on lower suspension arm pivot bolt. Do not tighten this nut until car is on all four wheels.

8. Insert shock absorber assembly up into coil spring and guide stem through tower in frame cross member. Place lower end in position on lower suspension arm. Install pivot bolt, lockwasher, and nut. Do not tighten nut until car is on all four wheels.

9. Install tie-strut on lower arm, securing with two bolts and nuts. Tighten nuts to 35 foot-pounds.

10. Connect stabilizer link to lower arm.

11. Install wheel assembly.

12. Replace wheel disc and lower front end of car.

13. Connect shock absorber at its upper mount.

14. Tighten nut on lower suspension arm pivot bolt to 60 foot-pounds.

15. Tighten nut at shock absorber lower mount in lower arm to 60 foot-pounds.

16. Check wheel alignment and adjust if necessary.

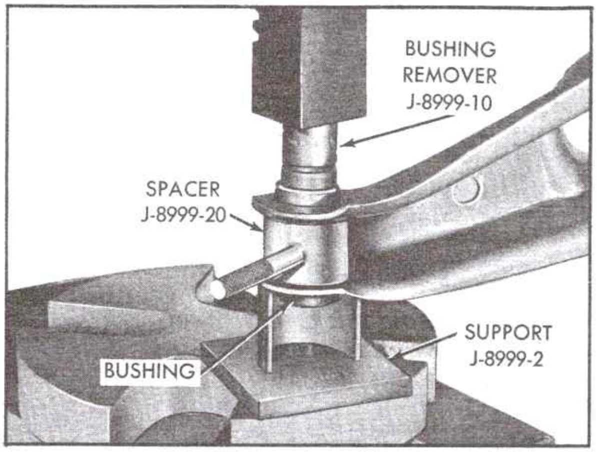


Fig. 3-23 Removing Bushing from Lower Arm

15. Front Lower Suspension Arm Bushing

a. Removal

1. Remove lower suspension arm and coil spring as described in Note 14a.

2. Use a stiff wire brush to clean the small outer diameter end of the bushing and the portion of the bushing between the legs of the arm.

   NOTE: This step will help prevent corrosion on the bushing outer sleeve from gouging grooves in the arm upon removal.

3. Position Support, J-8999-2, on arbor press anvil and insert larger diameter end of bushing in support.

4. To prevent lower arm from collapsing when bushing is pressed out, place Spacer J-8999-20 around inner flange of lower control arm. Inner flange is located on larger diameter bushing side.

5. Position Bushing Remover, J-8999-10, on sleeve, Fig. 3-23, and press bushing out of arm.

6. Inspect bushing holes in front lower control arm for distortion or gouges in holes. If arm is damaged, it will be necessary to replace the front lower control arm as an assembly.

b. Installation

1. Position Support, J-8999-2, on arbor press anvil and insert smaller diameter flanged end of bushing mount in support.

2. Install new bushing in arm, smaller diameter end of bushing first, until bushing pilots itself in opposite flanged end.

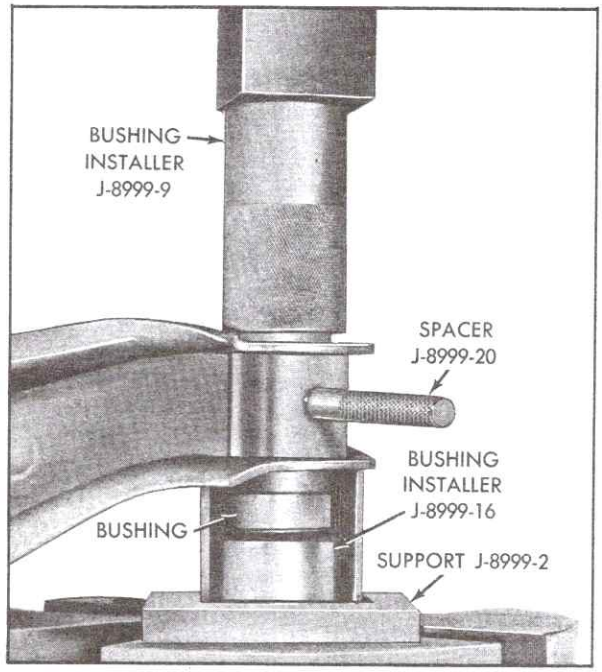


Fig. 3-24 Installing Bushing in Lower Arm

3. Place Spacer, J-8999-20, around inner flange of lower control arm.

4. Place Bushing Installer, J-8999-16, on Support, J-8999-2, Fig. 3-24.

5. Position Bushing Installer, J-8999-9, over end of bushing and press bushing into arm until the end of the inner sleeve bottoms on Bushing Installer, J-8999-16.

6. Install lower suspension arm and coil spring as described in Note 14b.

16. Steering Knuckle

a. Removal

1. Raise front end of car and place jack stands under front frame side rails.

2. Remove wheel assembly and brake drum.

3. Straighten locking plate on anchor bolt, remove anchor bolt, locking plate, and two bolts securing brake backing plate to steering knuckle. Position steering arm out of way.

4. Remove support plate, grease guard, and brake backing plate from steering knuckle spindle, Fig. 3-25 and wire backing plate to a convenient location to prevent damage to brake hose.

5. Place jack under lower suspension arm on side from which steering knuckle is to be removed.

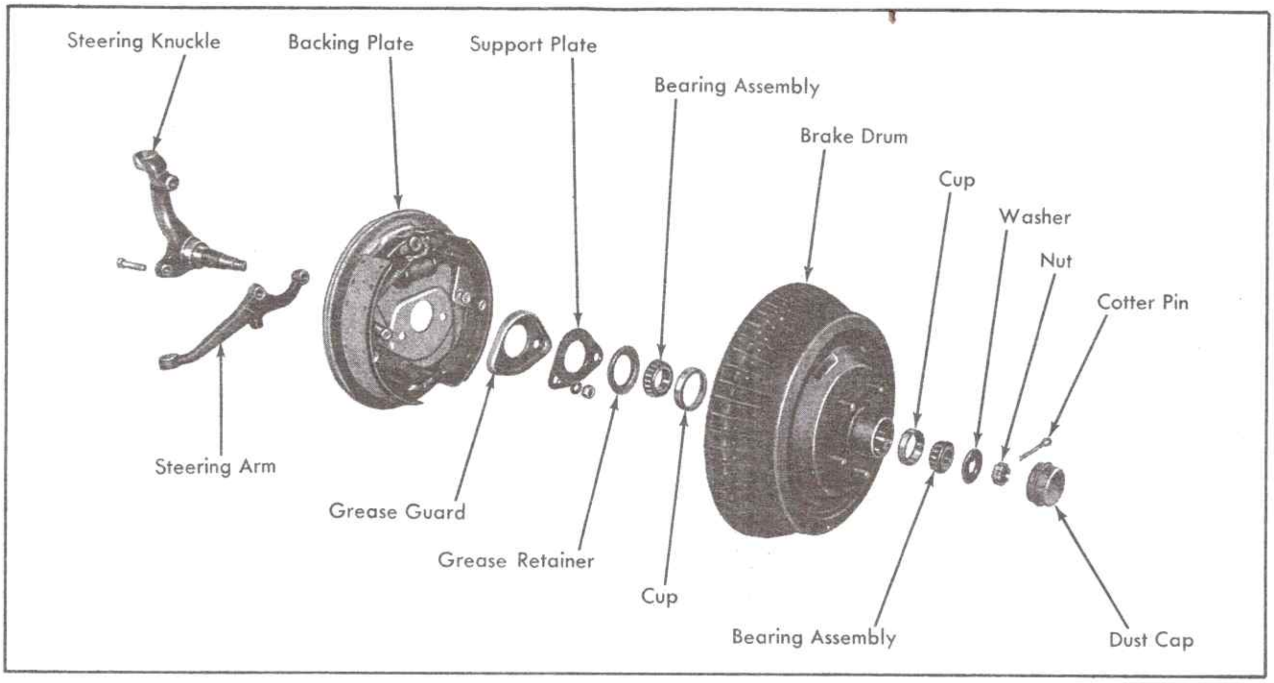


Fig. 3-25 Front Wheel Disassembled

6. Remove locknut from lower joint stud and strike knuckle support with a mallet in area of joint stud to break joint loose.

7. Remove locknut and special flat washer from upper spherical joint stud.

8. Remove joint from knuckle using a 7/16 inch steel rod approximately 20 inches long, rounded on one end. Thread a standard nut part way on stud and insert rounded end of rod inside nut. Then, using a heavy hammer, strike end of rod until joint is free from steering knuckle.

9. Raise up on upper arm and remove joint stud from upper steering knuckle support.

10. Remove steering knuckle from lower joint stud.

b. Installation

1. Guide upper joint stud into steering knuckle upper support and install a standard nut on joint stud. Tighten nut until camber eccentric locks in knuckle, then remove standard nut and install special flat washer and locknut, tightening to 60 foot-pounds.

2. Guide lower spherical joint stud into steering knuckle lower support.

3. Install standard nut on joint stud and tighten until stud locks in knuckle, then remove standard nut and install locknut, tightening to 65 foot-pounds.

4. Position brake backing plate on steering knuckle spindle, install locking plate, and start anchor bolt into upper knuckle support.

5. Install grease guard and support plate on steering knuckle spindle. Position steering arm between lower knuckle and brake backing plate and install two bolts through knuckle, arm, and brake backing plate assembly. Tighten to 60 foot-pounds.

NOTE: Install bolts with bolt heads against mounting boss of steering knuckle and nuts butting against support plate, Fig. 3-25.

6. Tighten anchor bolt to 100 foot-pounds and bend locking plate over one flat of bolt head.

7. Install brake drum and wheel assembly.

8. Adjust wheel bearings.

9. Replace dust cap and wheel disc and lower car.

10. Check wheel alignment and adjust if necessary.

17. Steering Arm

a. Removal

1. Raise front end of car and place jack stands under front frame side rails.

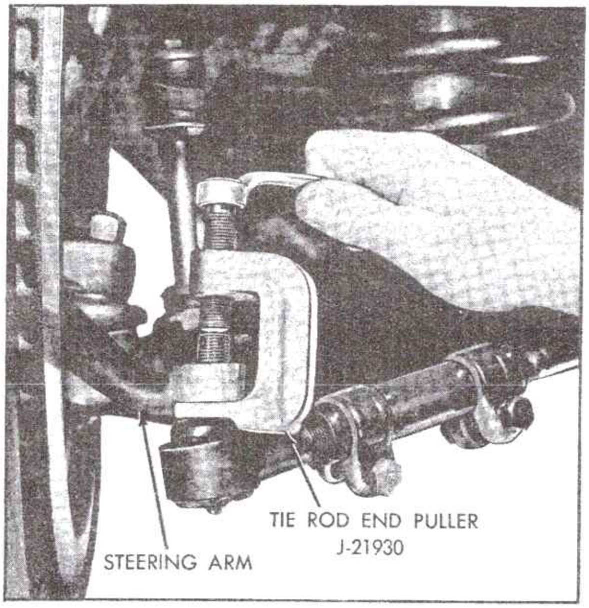


Fig. 3-26 Removing Tie Rod Joint Stud from Steering Arm

2. Remove wheel assembly and brake drum.

3. Straighten locking plate on anchor bolt and loosen anchor bolt.

4. Remove two bolts securing brake backing plate to steering knuckle, and drop steering arm and tie-rod end.

5. Remove cotter pin and nut from joint stud on end of tie-rod.

6. Remove tie-rod joint stud from steering arm, using Tie-Rod End Puller, J-21930, Fig. 3-26, and remove steering arm.

b. Installation

1. Position steering arm between lower steering knuckle support and brake backing plate and install two bolts through knuckle, arm, and brake backing plate assembly. Tighten to 60 foot-pounds.

NOTE: Install bolts with bolt heads against mounting boss of steering knuckle, and nuts butting against support plate, Fig. 3-25.

2. Tighten anchor bolt to 100 foot-pounds, and bend locking plate over one flat of bolt head.

3. Install tie-rod end joint stud in steering arm and secure with nut, tightening to 40 foot-pounds. Install cotter pin.

4. Install brake drum and wheel assembly.

5. Adjust wheel bearings as described in Section 10, Note 3a.

6. Replace dust cap and wheel disc and lower car.

7. Check wheel alignment and adjust if necessary.

18. Bent Parts Straightening

The straightening of bent parts in the front suspension system should be attempted only within the following limits.

Parts should be replaced rather than straightened if they are sprung out of alignment more than five degrees. Excessive bending of parts when cold may result in stresses or cracks invisible to the naked eye, which make the part unsafe for use. Straightening with heat will destroy the effect of previous heat treatment, leaving the steel seriously weakened.

Welding of parts subjected to high stresses should never be attempted, because the welding process will change the grain structure of the metal, making it unsafe.

FRONT SUSPENSION DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Car pulls to one side	Drag link height not properly adjusted.	Adjust drag link height.
	Uneven tire pressure.	Inflate tires to proper pressure.
	Uneven tire wear.	Interchange tires.
	Brakes grabbing.	Clean and adjust.
	Uneven caster or camber.	Check and adjust caster or camber as necessary.
	Rear wheels not tracking with front wheels.	Check alignment of rear wheels with front wheels.
	Shock absorbers inoperative.	Replace shock absorbers.
	Wheel bearings adjusted too tight.	Check for binding with front wheels off floor. Adjust and lubricate bearings.
	Front springs sagging.	Check spring height and replace if necessary.
	Upper or lower suspension arm mounting bolts loose.	Tighten to specified torque.
	Steering arm bent.	Replace with new arm.
	Frame bent or broken.	Check frame for proper alignment or breakage. Repair or replace as necessary.
	Steering gear valve off center.	Install new valve assembly.
Scuffed tires	Toe-in incorrect.	Adjust toe-in to specifications.
	Excessive speed on turns.	Advise driver.
	Tires improperly inflated.	Inflate tires to proper pressure.
	Wheels or tires out of round.	Check for wheel and tire wobble. See that wheels and tires are properly mounted. Replace wheels or tires if necessary.
	Suspension arm bent or twisted.	Replace arm.
Cupped tires	Excessive tire or wheel runout.	Compensate for runout as explained in Section 10, Note 2.
	Tires improperly inflated.	Inflate tires to proper pressure.
	Wheels, tires or brake drum out of balance.	Balance wheels and tires.

CONDITION	CAUSE	CORRECTION
Cupped Tires (cont'd.)	Front shock absorbers inoperative.	Replace shock absorbers.
	Worn upper spherical joints.	Replace arm assembly.
	Worn lower spherical joints.	Replace joints.
	Incorrect drag link height.	Correct according to specifications.
	Wheel bearings incorrectly adjusted or worn.	Adjust or replace bearings as necessary.
Front wheel shimmy	Wheels, tires or brake drums out of balance.	Balance wheels and tires.
	Wheels or tires out of round.	Check for tire and wheel wobble or out of round. See that wheels and tires are properly mounted.
	Rough tire.	Isolate and replace.
	Steering gear or steering connections incorrectly adjusted or worn.	Check and adjust to specifications.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Damaged spherical joint seals.	Replace and repack seals.
	Front wheel bearings incorrectly adjusted or worn.	Adjust or replace if necessary.
	Shock absorbers inoperative.	Check and replace if necessary.
Car wanders	Steering gear or connections adjusted too loose or worn.	Adjust or install new parts as necessary.
	Drag link height incorrect.	Check and adjust to specifications.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Toe-in or caster incorrectly adjusted.	Adjust toe-in and caster.
	Tires which are not original equipment.	Install original equipment.
	Excessive friction in front suspension.	Check spherical joint seals for damage. If necessary, replace seals and repack joints.
	Front standing height incorrect.	Check standing height and adjust as necessary.
	Upper or lower suspension arm mounting bolts loose.	Tighten to specified torque.

CONDITION	CAUSE	CORRECTION
Road shock	High tire pressure.	Deflate tire to proper pressure.
	Steering gear or connections incorrectly adjusted.	Adjust steering gear and connections.
	Shock absorbers inoperative.	Check shocks and replace if necessary.
	Front springs weak or sagging.	Check spring height and replace if necessary.
	Non-standard or incorrect size tires used.	Install new tires of correct size and type.
Hard riding	Excessive friction in front suspension.	Check spherical joint seals for damage. If necessary, replace seals and repack joints.
	Tires overinflated.	Correct tire pressure.
	Shock absorbers.	Check and replace if necessary.
	Springs with incorrect rating being used.	Install springs with correct rating.

TORQUE SPECIFICATIONS (EXCEPT 693)

Material No.	Application	Size	Foot-Pounds
300-M	Anchor bolt, brake backing plate to steering knuckle	9/16-18	100
301-M	Steering knuckle and arm to brake backing plate	1/2-20	60
380-M	Spherical joint to knuckle (lower)	5/8-18	65
301-M	Spherical joint to knuckle (upper)	1/2-20	60
260-M	Stabilizer bracket to frame attaching bolts	3/8-24	20
301-M	Suspension arm shaft to frame locknuts (upper)	1/2-20	60
300-M	Suspension arm shaft attaching bolts (at bushings) 1-1/4"	3/8-24	60
301-M	Suspension arm to frame (lower)	1/2-20	60
301-M	Front shock absorber to lower arm nut .	7/16-14	60
286-M	Tie rod adjuster clamp nuts	3/8-24	20
286-M	Tie rod pivots to steering arms	1/2-20	40
301-M	Tie-strut to lower arm	7/16-20	60
301-M	Tie-strut to frame at front bushing. . .	3/4-16	35

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings, and steel classifications.

SPECIFICATIONS

Item	All Series Unless Otherwise Noted
Steering axis inclination	6°
Camber of front wheels	
Left	+3/8° to -1/8°
Right	+1/8° to -3/8°
(Left wheel must have 1/4° to 1/2° more positive camber than right wheel to compensate for crowned road pull. See chart on Page 3-6 for acceptable camber combinations.)	
Preferred camber	
Left	0°
Right	-1/4°
Caster angle	-1/2° to -1-1/2°
Preferred caster	-1°
(Caster variation between wheels not to exceed 1/2°).	
Toe-in (car on ground)	3/16" to 1/4"
Turning radius (curb to curb)	
680, 681	22' 10"
682, 683	22' 3-1/2"
Fleetwood Seventy-Five Sedans and Limousines	24'
Commercial Chassis	27' 8"
Outside wheel angle with inside wheel at 20° is 18° 10'.	

FRONT COIL SPRING CHART

Style	Color or Code*	Normal Load	Rate per Inch
68069, 68169 (Without Automatic Climate Control)	Orange - AG	2650	315-335 lbs.
68069, 68169, 68247, 68347 (With Automatic Climate Control)	Yellow - AK	2750	340-360 lbs.
68249, 68269, 68349, 68369 (Without Automatic Climate Control)	Gray - AC	2600	315-335 lbs.
68249, 68269, 68349, 68369 (With Automatic Climate Control)	Dk. Blue - AH	2700	315-335 lbs.
68247, 68347, 68367 (Without Automatic Climate Control)	Lt. Blue - AA	2550	315-335 lbs.
69723, 69733	Purple - AL	3000	437-463 lbs.
69890	Green - AE	2900	582-618 lbs.
HEAVY DUTY			
All but 69723, 69733, 69890	None - AM	2850	398-422
69723, 69733, 69890	Lilac - AF	3200	582-618 lbs.

*Springs may be identified by a color daub, code letters or both.

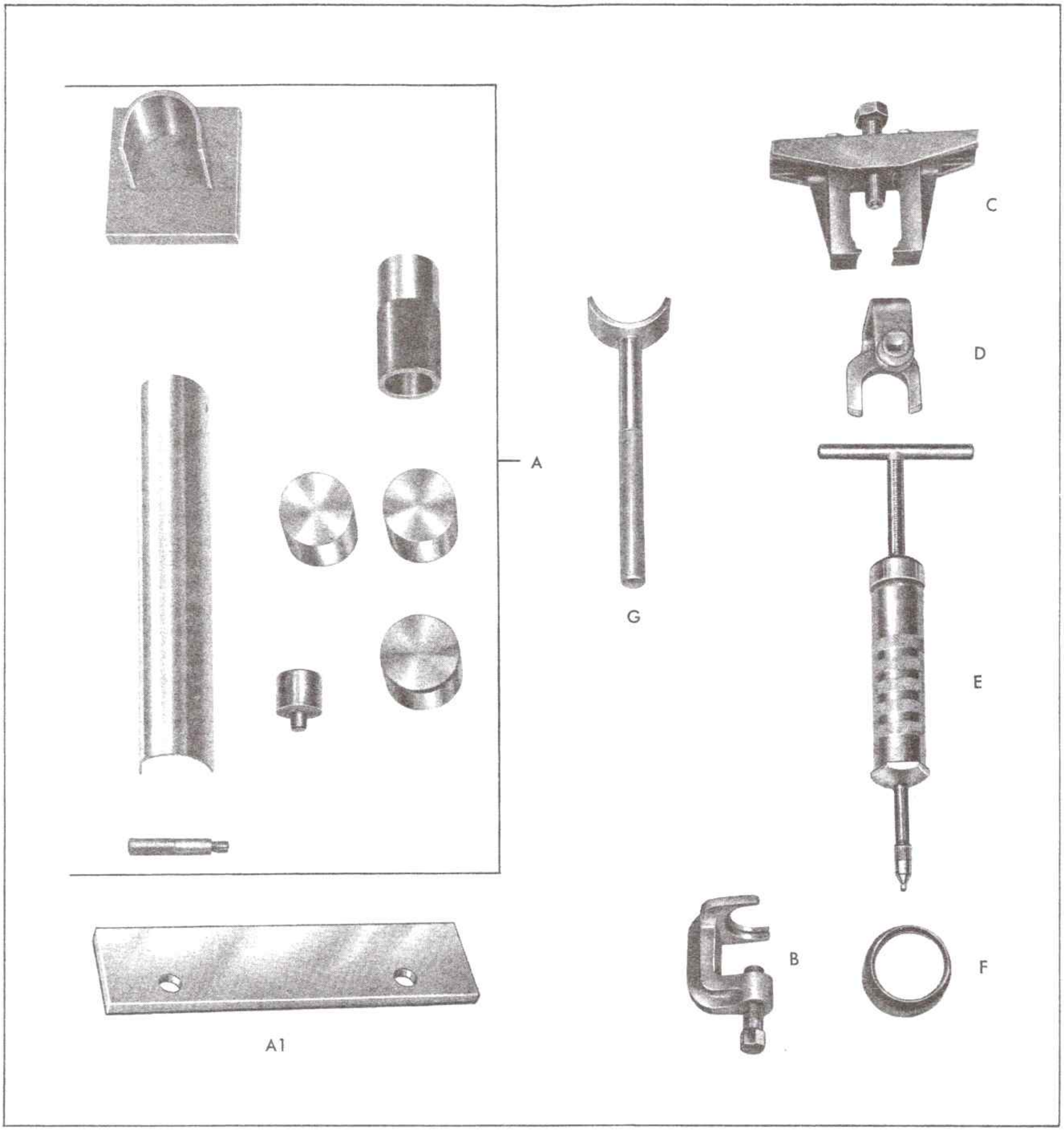


Fig. 3-27 Special Tools (Except 693)

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8999	Front Suspension Service Set	D	J-9231	Camber Adjusting Wrench
A1	None	Bushing Remover Spacer (2)	E	J-9280	Repacking Gun (Spherical Joints)
B	J-21930	Tie Rod End Puller	F	J-9148	Garter Spring Installer
C	J-8990	Puller Front Suspension	G	J-8999-20	Spacer

FLEETWOOD ELDORADO

GENERAL DESCRIPTION

The service information that follows pertains only to the Fleetwood Eldorado. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as given in the first part of this section.

The front suspension on the Fleetwood Eldorado (693 Series), consists of two upper and two lower control arms, a stabilizer bar, shock absorbers and a right and left torsion bar, Fig. 3-29. Torsion bars are used instead of the conventional coil springs. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into an adjustable arm in the torsion bar crossmember. The standing height of the car is controlled by this adjustment.

19. Hub, Bearing and Retainer (Figs. 3-28 and 3-30)

a. Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Remove drive axle cotter pin.
4. Loosen hub to drive axle nut.
5. Raise car and place jack stands near outer end of lower control arms.
6. Remove hub nut, washer and wheel mounting nuts, and remove wheel and tire.
7. Remove drum.

   NOTE: On cars with disc brakes, remove caliper assembly as described in Section 5, Note 26a. Eliminate steps 8 and 9 that follow and proceed with step 10.

8. Remove brake line clip attached to chassis.
9. Separate brake hose from brake line.
10. Remove upper spherical joint cotter pin and loosen nut.

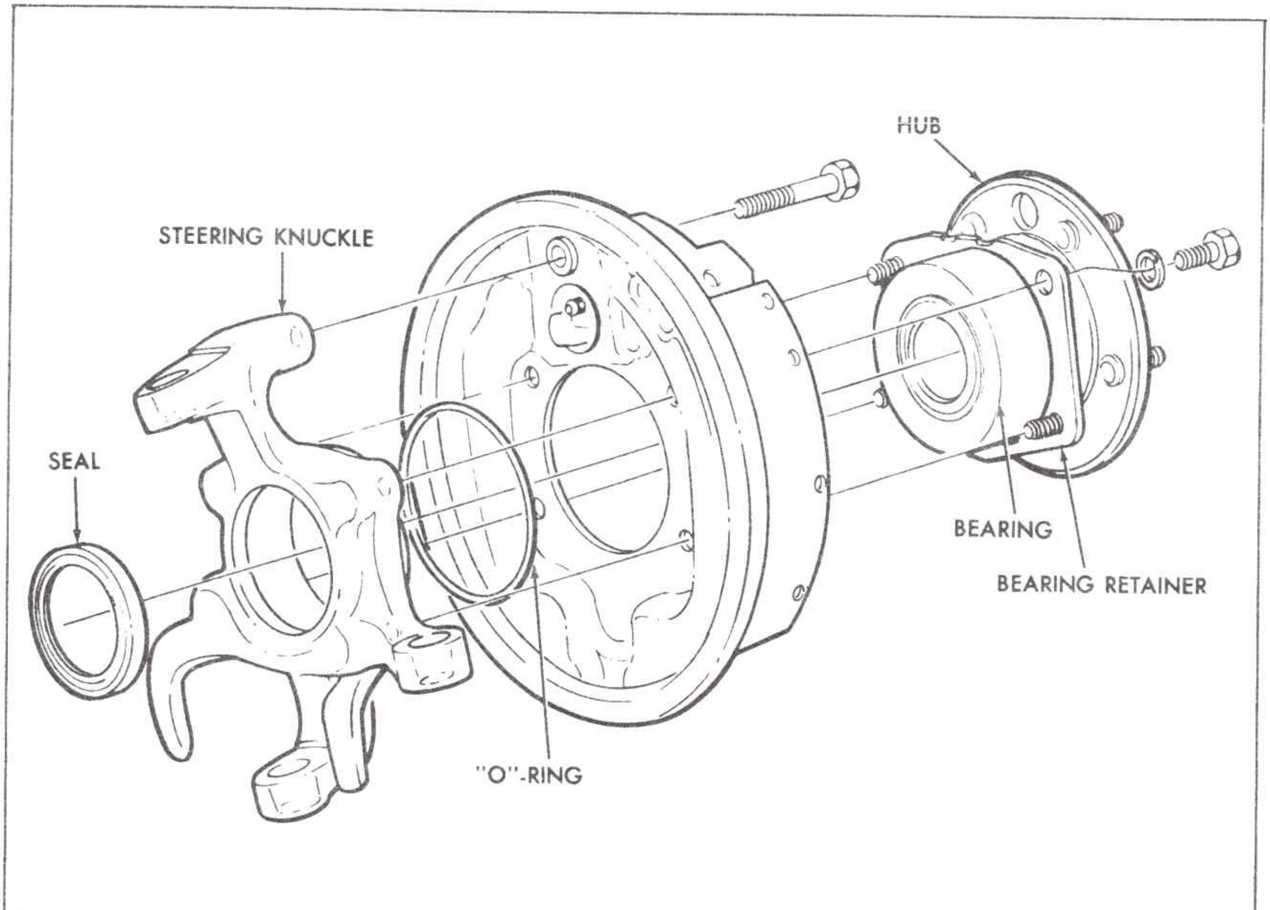


Fig. 3-28 Front Hub, Bearing and Retainer

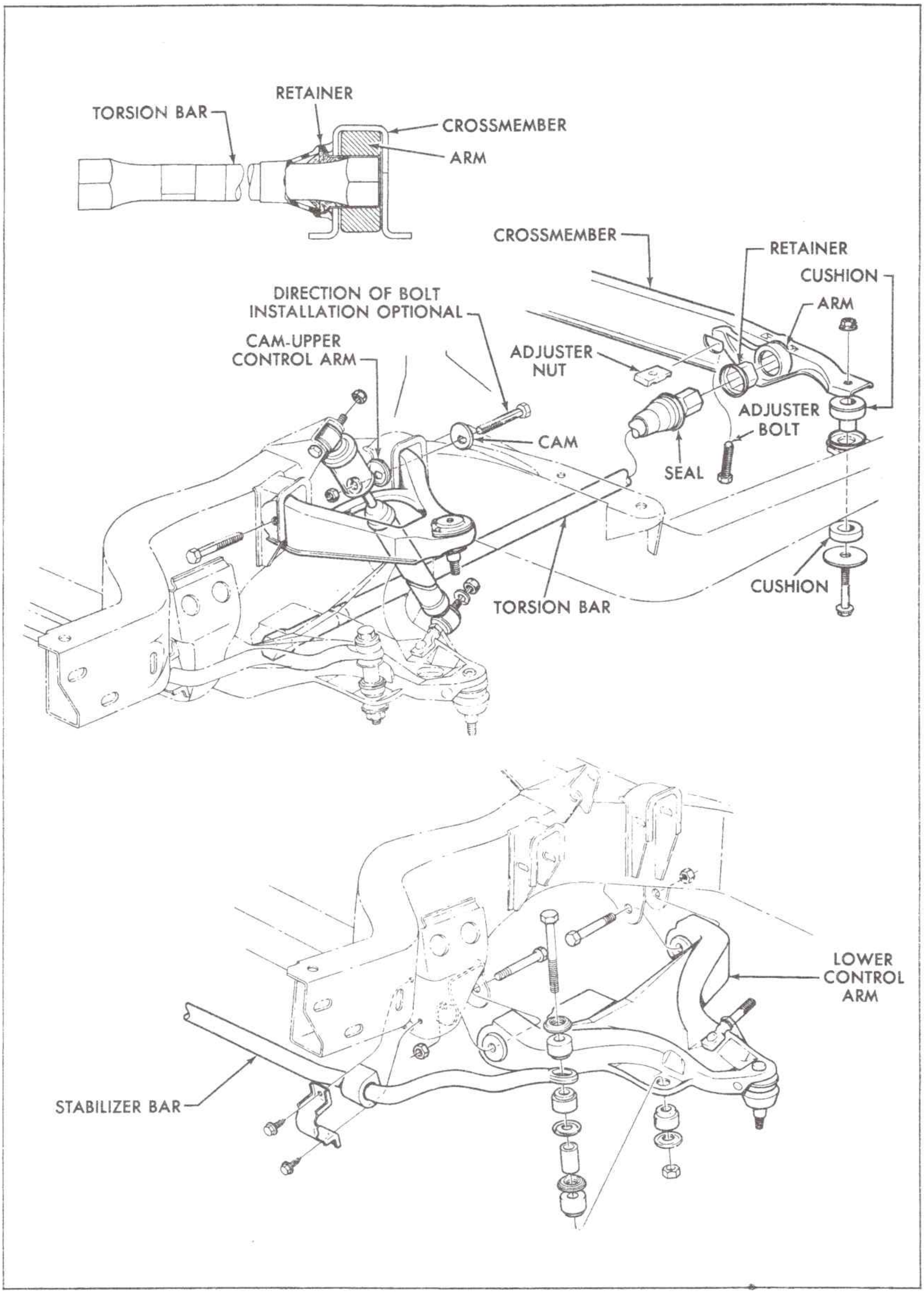


Fig. 3-29 Front Suspension Disassembled (693)

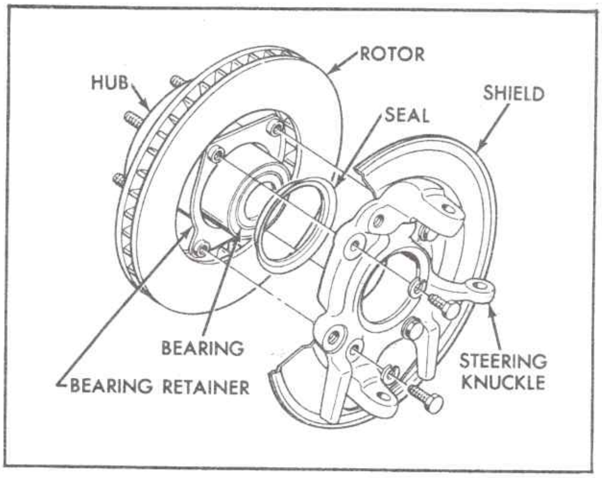


Fig. 3-30 Front Hub Bearing and Retainer (Disc Brake)

11. Using a hammer and drift, strike steering knuckle until upper spherical joint is loose.

12. Remove tie rod end cotter pin and nut.

13. Using Tie Rod End Puller, J-21930, disconnect tie rod end at steering knuckle.

14. Remove lower spherical joint cotter pin and nut.

15. Using Ball Joint Puller, J-22292, and adapter, J-22292-3, disconnect lower spherical joint.

16. Remove upper spherical joint nut and remove joint stud from steering knuckle.

17. Remove hub, backing plate and knuckle as an assembly.

b. Disassembly (Fig. 3-31)

1. Install Small Bushing, J-22214-1, in upper end of steering knuckle.

2. Install Large Bushing, J-22214-2, in lower end of steering knuckle.

3. Install Small Pilot, J-22214-6, through steering knuckle and into hub.

4. Install Knuckle Remover, J-22214-5, between upper and lower ends of steering knuckle.

5. Secure knuckle remover to steering knuckle by installing two small bolts, J-22214, through bushings previously installed.

6. Secure Knuckle Remover, J-22214-5, with assembly attached, in a vise, Fig. 3-32.

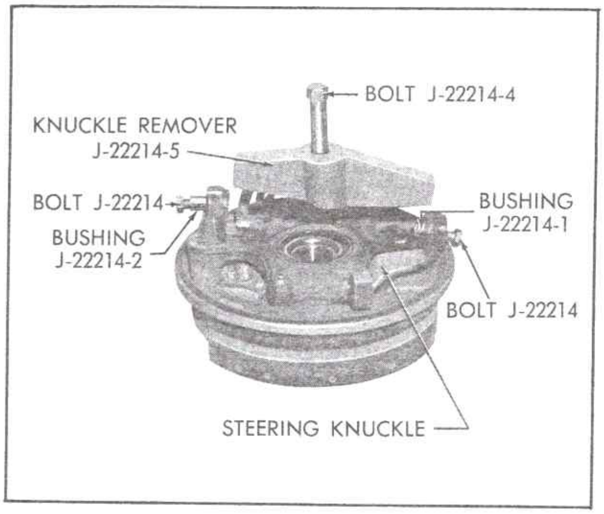


Fig. 3-31 Hub and Bearing Removal Tools

7. Coat Large Bolt, J-22214-4 with E.P. chassis lubricant and install bolt in Knuckle Remover, J-22214-5.

8. Tighten Large Bolt, J-22214-4, until hub is pressed out of bearing.

9. Remove Large Bolt, J-22214-4, and Small Pilot, J-22214-6.

NOTE: On cars with disc brakes, remove four bolts securing bearing retainer to backing plate. The bolts securing the retainer, pass through the steering knuckle from the back side and into the bearing retainer. Eliminate step 10 which follows and proceed with step 11.

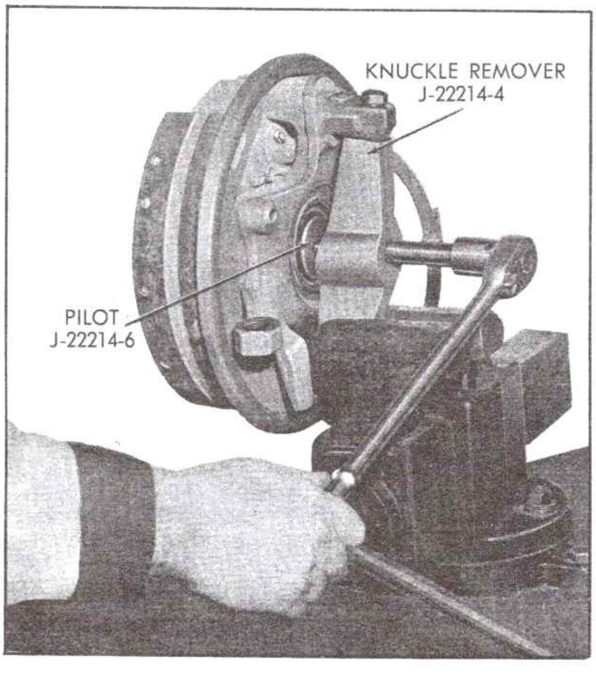


Fig. 3-32 Removing Hub from Knuckle

10. Remove four bearing retainer bolts from inner face of assembly and remove bearing retainer.

11. Install Large Pilot, J-22214-3, through steering knuckle and seat pilot on bearing.

12. Coat Large Bolt, J-22214-4, with E.P. chassis lubricant and install bolt in Knuckle Remover, J-22214-5.

13. Tighten Large Bolt, J-22214-4, until bushing is pressed out of steering knuckle.

14. Remove hub and bearing tools from steering knuckle.

15. Pry steering knuckle to drive axle seal out of steering knuckle and discard seal.

16. If steering knuckle is removed from backing plate, discard O-ring between steering knuckle and backing plate.

c. Assembly

1. Install bearing retainer over small end of hub.

2. Lubricate new bearing with E.P. chassis lubricant.

3. Position bearing retainer and bearing on hub and place hub on arbor press with bearing seated on bed of press. Install Bushing Installer, J-8999-16, in stud end of hub and press bearing on hub, Fig. 3-33.

4. If steering knuckle was removed from backing plate, install a new O-ring and attach steering knuckle to backing plate.

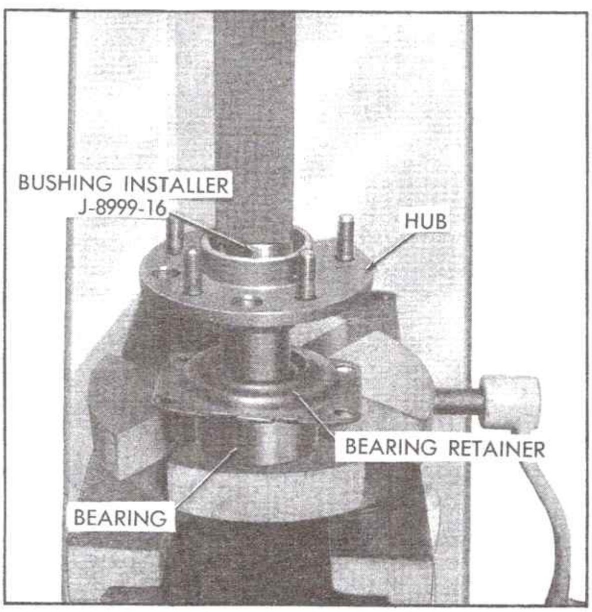


Fig. 3-33 Installing Bearing on Hub

5. Lubricate bearing and steering knuckle and press hub and bearing into steering knuckle.

6. Align holes in bearing retainer with holes in backing plate.

NOTE: On cars with disc brakes, install four bolts through steering knuckle and backing plate and secure bearing retainer to backing plate. Eliminate step 7 which follows.

7. Install four bolts securing bearing retainer to backing plate.

8. Lubricate new steering knuckle-to-drive axle seal with E.P. chassis lubricant.

9. Using Seal Installer, J-22234, install seal in steering knuckle.

d. Installation

1. Install lower spherical joint in steering knuckle and install nut. Do not tighten nut at this time.

2. Align splines in hub with splines on drive axle and install drive axle to hub washer and nut.

CAUTION: Use extreme care when indexing splines in hub with splines on drive axle.

3. Install upper spherical joint in steering knuckle.

NOTE: On cars with disc brakes, install Caliper assembly as described in Section 5, Note 26b. Eliminate steps 4, 5, 6, which follow and proceed with step 7.

4. Install brake hose clip and nut on upper spherical joint stud. Do not tighten nut at this time.

5. Attach brake hose to brake line.

6. Attach brake line clip to chassis.

7. Install tie rod end in steering knuckle and install nut. Do not tighten nut at this time.

8. Tighten nut on upper spherical joint stud to 40 foot-pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

9. Tighten nut on lower spherical joint stud to 40 foot-pounds and install cotter pin.

10. Tighten tie rod end nut to 30 foot-pounds and install cotter pin.

11. Install drum.

12. Install wheel and tire.

13. Raise car, remove jack stands and lower car.

14. Tighten wheel mounting nuts to 105 foot-pounds.

15. Tighten drive axle to hub nut to 105 foot-pounds and install cotter pin.

16. Install wheel disc.

17. Bleed and adjust brakes as described in Section 5, Note 9, 22.

20. Steering Knuckle

a. Removal

1. Remove wheel disc.

2. Remove drive axle cotter pin and loosen nut.

3. Loosen wheel mounting nuts.

4. Raise car and place jack stands under lower control arms.

5. Remove drive axle to hub nut and washer and wheel mounting nuts.

6. Remove wheel and tire.

7. Remove drum.

NOTE: It may be necessary to back off the brake shoe adjustment before drum can be removed.

8. Remove hub assembly as described in Note 19a.

9. Remove upper spherical joint cotter pin and nut.

10. Remove brake line hose clip from spherical joint stud.

NOTE: Do not loosen spherical joint stud.

11. Remove brake line clip at chassis.

12. Bend lock plate on brake backing plate anchor bolt up and remove anchor bolt.

13. Carefully lift brake backing plate outboard over end of axle shaft and support so brake line and hose are not damaged.

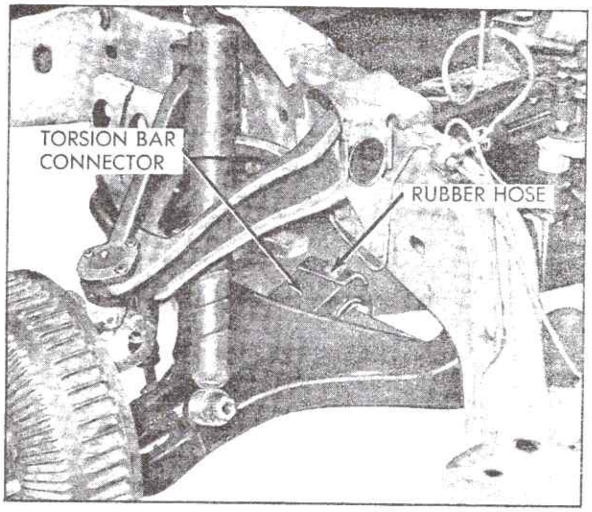


Fig. 3-34 Rubber Hose Location

14. Place a short length of rubber hose over the lower control arm torsion bar connector. Fig. 3-34.

NOTE: Use extreme care to prevent damage to the drive axle constant velocity joint and seal on the torsion bar connector.

15. Using a brass drift and hammer, loosen upper spherical joint stud.

16. Remove cotter pin and nut from tie-rod end.

17. Remove tie-rod end from steering knuckle, using Tie Rod End Puller, J-21930.

18. Remove cotter pin and nut from lower spherical joint stud.

19. Using Ball Joint Puller, J-22292, and adapter, J-22292-3, disconnect lower spherical joint at steering knuckle.

NOTE: Use extreme care when installing adapter, J-22292-3 between spherical joint seal and steering knuckle.

20. Guide knuckle over end of drive axle and remove from car.

NOTE: If steering knuckle seal is to be replaced, use a pry bar to remove seal from knuckle.

CAUTION: Do not pry against steering knuckle hub bearing race.

b. Installation

1. If steering knuckle seal was removed, use Seal Installer, J-22234, and install seal in knuckle.

2. Guide knuckle over drive axle and install lower spherical joint stud into knuckle and attach nut. Do not tighten nut at this time.

3. Install tie-rod end stud into knuckle and attach nut. Do not tighten nut at this time.

4. Install upper spherical joint stud into knuckle and attach nut. Do not tighten nut at this time.

5. Install brake line clip on chassis.

6. Install backing plate onto knuckle with anchor bolt and lock plate. Do not tighten bolt at this time.

7. Remove upper spherical joint nut and install brake line hose clip.

8. Install upper spherical joint nut and tighten to 40 foot-pounds and install cotter pin. Bend cotter pin up.

NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.

CAUTION: Cotter pin must be bent up to prevent interference with or damage to the drive-axle constant velocity joint or seal.

9. Tighten tie-rod end nut to 30 foot-pounds and install cotter pin.

10. Tighten brake backing plate anchor bolt to 135 foot-pounds and bend lock plate onto flat of bolt head.

11. Install hub assembly as described in Note 19d.

12. Remove piece of rubber hose on lower control arm torsion bar connector.

13. Install drum.

14. Install drive axle washer and nut. Do not tighten nut at this time.

15. Install wheel and tire. Do not tighten mounting nuts at this time.

NOTE: If brake shoe adjustment was backed off, adjust brakes.

16. Remove jack stands and lower car.

17. Tighten wheel mounting nuts to 105 foot-pounds.

18. Tighten hub to drive axle nut to 105 foot-pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

19. Install wheel disc.

20. Check camber, caster and toe-in and adjust if necessary.

21. Steering Knuckle "O" Ring Seal

a. Removal

1. Remove wheel and tire, drum and hub assemblies as described in Note 19a.

2. Remove upper spherical joint cotter pin and nut.

3. Remove brake line hose clip from spherical joint stud.

NOTE: Do not loosen spherical joint stud.

4. Bend lock plate on anchor bolt up and remove anchor bolt.

5. Remove brake line clip at chassis.

6. Carefully lift brake backing plate outboard over end of axle shaft and support so brake line and hose are not damaged.

7. Remove O-ring seal. Fig. 3-29.

b. Installation

1. Install O-ring seal.

2. Carefully lift brake backing plate inboard over end of axle shaft and support so brake line and hose are not damaged.

3. Install anchor bolt and bend lock plate on anchor bolt down.

4. Install brake line clip at chassis.

5. Install brake line hose clip on upper spherical joint stud.

6. Install upper spherical joint nut and cotter pin. Tighten nut to 40 foot-pounds.

NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.

7. Install hub assembly, drum, wheel and tire as described in Note 19d.

22. Torsion Bar

a. Removal

1. Remove wheel disc.

2. Loosen wheel mounting nuts.

3. Raise car and place on jack stands.

4. Remove wheel and tire.

NOTE: Install one or two nuts to prevent drum from falling off of car.

5. Remove hub cotter pin, nut and washer.

6. Remove brake line clip attached to frame.

7. Place a hydraulic jack under lower control arm on side that torsion bar is being removed.

8. Using a hammer and drift, disconnect upper spherical joint and remove nut and brake line clip.

9. Disconnect shock absorber at lower mount.

10. Using Tie Rod End Puller, J-21930, disconnect tie rod end at steering knuckle.

11. Disconnect stabilizer bar, and discard bolt and nut.

12. Using Ball Joint Puller, J-22292, and Adapter J-22292-3, disconnect lower spherical joint.

13. Disengage backing plate assembly from drive axle and secure assembly to the upper control arm with a piece of wire.

14. Remove lower control arm to frame attaching nuts.

NOTE: Do Not remove control arm to frame attaching bolts at this time.

15. Slowly let the hydraulic jack under the lower control arm down and position jack out of way.

NOTE: The torsion bar is now unloaded and the lower control arm is hanging free.

16. Remove torsion bar adjusting bolt at frame crossmember.

17. Pull down on outer end of lower control arm with one hand, while reaching back with other hand to remove torsion bar adjusting nut from frame crossmember.

18. Remove lower control arm to frame attaching bolts.

19. Disengage lower control arm from frame mounts.

20. Using extreme care, slide lower control arm off of torsion bar. Slide torsion bar out of frame crossmember retainer and remove from car.

b. Inspection

1. Check rubber seal for damage. Replace if necessary.

2. A new retainer must be used when the torsion bar is replaced.

3. Check torsion bar for nicks, scratches or dents. If these conditions exist, the torsion bar must be replaced.

c. Installation

1. Lubricate both ends of torsion bar for approximately 3" with lubriplate.

2. Lubricate torsion bar retainer in crossmember.

3. Using extreme care, place torsion bar in retainer at chassis crossmember.

NOTE: The torsion bar ends are marked and must be installed as indicated. It is possible to reverse the torsion bar when installing.

4. Lubricate lower control arm torsion bar connector and position lower control arm on torsion bar.

NOTE: When installing control arm, make sure that arm is installed in the on car position and is level. Also check torsion bar, making certain that torsion bar is fully seated in chassis crossmember.

5. Using a hydraulic jack, raise lower control arm into position and install in mounts on chassis. Do not tighten nuts at this time.

6. Pull down on lower control arm with one hand, and with other hand, install torsion bar lock nut through chassis crossmember and under arm.

7. Lubricate adjusting bolt with E.P. chassis lubricant and install bolt. Do Not tighten bolt at this time.

8. Remove wire and install backing plate and knuckle assembly on drive axle.

9. Place lower spherical joint in steering knuckle. Tighten nut to 40 foot-pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

10. Lift up upper control arm and install spherical joint in steering knuckle.

11. Install brake line clip on upper spherical joint stud. Tighten nut to 40 foot pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

12. Install shock absorber on lower control arm and tighten nut to 75 foot pounds.

13. Install tie rod end in steering knuckle and tighten nut to 30 foot-pounds.

14. Install stabilizer bar on lower control arm as described in Note 31.

15. Install brake line clip on chassis.

16. Tighten lower control arm to chassis mount nuts to 65 foot pounds.

17. Install hub to axle washer and nut. Do not tighten nut at this time.

18. Remove nuts used to retain drum.

19. Install wheel and tire. Do not tighten nuts at this time.

20. Raise car and remove jack stands and hydraulic jack, then lower car.

21. Tighten hub to drive axle nut to 105 foot pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

22. Tighten wheel nuts to 105 foot-pounds.

23. Install wheel disc.

24. Check standing height as described in Note 34.

25. Check front end alignment and adjust if necessary as described in Note 33.

23. Upper Control Arm

a. Removal

NOTE: The upper control arm can be serviced either as an assembly, or by its component parts. If it is not necessary to replace the control arm as an assembly, there are two service packages available. One package contains bushings only, the other package consists of a spherical joint, two bolts, one nut and a cotter pin.

1. Remove wheel disc.

2. Loosen wheel mounting nuts.

3. Raise car and place on jack stands.

4. Remove wheel mounting nuts and remove wheel and tire.

NOTE: Install one or two nuts to prevent drum from falling off of car.

5. Disconnect shock absorber at upper mount.

6. Remove cotter pin and nut on upper spherical joint.

7. Remove brake hose clip from spherical joint stud.

8. Using a hammer and drift, disengage spherical joint stud and remove from steering knuckle.

9. Remove upper control arm cam assemblies and remove control arm and shims from car.

b. Installation

1. Guide upper control arm over shock absorber and install bushing ends and shims into frame mounts.

2. Install cam assemblies as shown in Fig. 3-45A, on page 3-39.

NOTE: The front cam is mounted up. The rear cam is mounted down.

3. Install shock absorber in upper mount. Tighten nut to 75 foot-pounds.

4. Install upper spherical joint into steering knuckle.

5. Install brake line clip, nut and cotter pin on upper spherical joint stud. Tighten nut to 40 foot-pounds.

NOTE: Use extreme care when performing step 5 to prevent damage to brake line.

CAUTION: Cotter pin must be crimped toward upper control arm to prevent damage to the outer constant velocity joint seal.

6. Remove nuts used to retain drum and install wheel and tire. Tighten nuts to 105 foot-pounds.

7. Raise car. Remove jack stands and lower car.

8. Check caster, camber, and toe-in as described in Note 33 and adjust.

9. Check standing height as described in Note 34 and adjust.

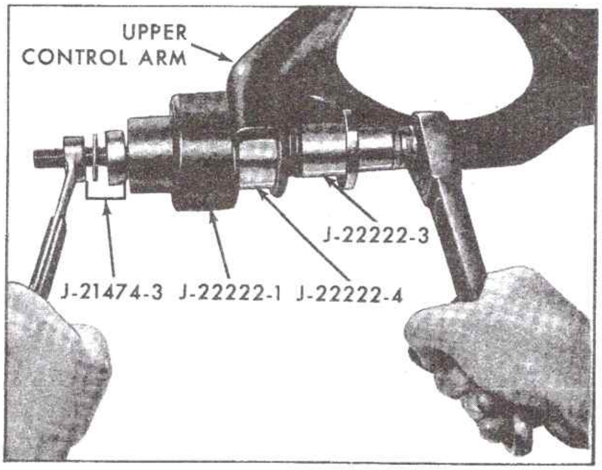


Fig. 3-35 Removing Upper Control Arm Bushings

24. Upper Control Arm Bushing (On Car)

a. Removal

NOTE: The upper control arm bushings can be removed and installed on or off the car.

1. Remove wheel disc.

2. Loosen wheel mounting nuts.

3. Raise car and remove wheel and tire.

NOTE: Install one or two nuts to prevent drum from falling off of car.

4. Disconnect shock absorber at upper mount and remove nut and bolt.

5. Remove upper control arm cam assemblies and nuts.

6. Remove upper control arm and shims from frame mounts.

7. Attach bushing removal tools as shown in Fig. 3-35.

8. Remove bushings and removal tools.

b. Installation

1. Place bushings in control arm.

2. Install tools as shown in Fig. 3-36,and press bushings into control arm.

3. Remove bushing removal tools.

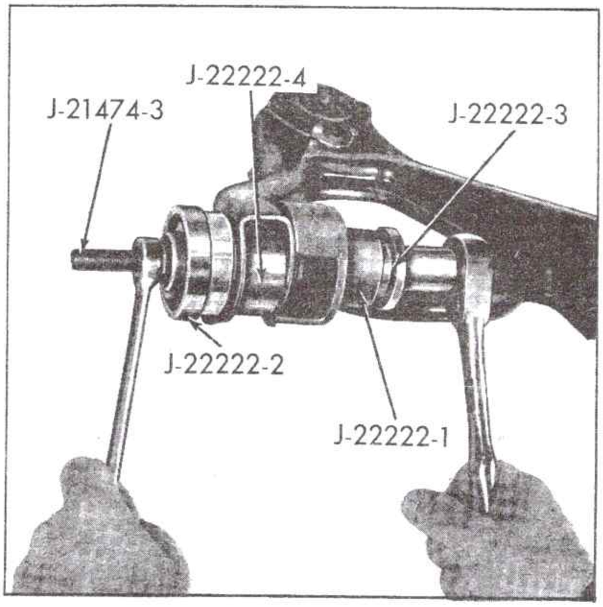


Fig. 3-36 Installing Upper Control Arm Bushings

4. Guide upper control arm over shock absorber and install bushing ends and shims into frame mounts.

5. Install cam assemblies as shown in Fig. 3-45A, on page 3-39.

NOTE: The front cam is mounted up. The rear cam is mounted down.

6. Install shock absorber in upper mount. Tighten nut to 75 foot-pounds.

7. Remove nuts used to retain drum and install wheel and tire.

8. Lower car and tighten wheel nuts to 105 foot pounds.

9. Install wheel disc.

10. Align front wheels as described in Note 33.

11. Check standing height as described in Note 34 and adjust if necessary.

25. Upper Control Arm Spherical Joint

a. Removal

1. Remove upper control arm as described in Note 23a.

2. Place upper control arm on workbench and grind the head off three rivets.

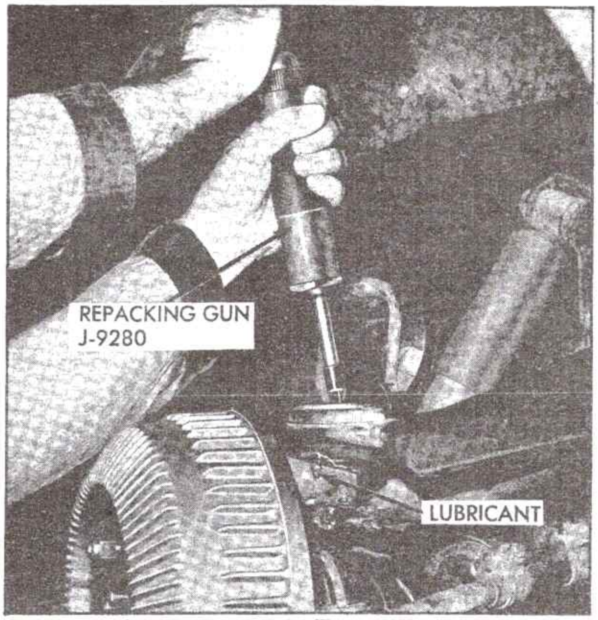


Fig. 3-37 Repacking Upper Spherical Joint (693)

3. Using a hammer and punch, drive on center of rivets until ball joint can be removed from control arm.

b. Installation

1. Install new ball joint in upper control arm.

2. Install three bolts in top side of control arm.

3. Install three nuts from under side of control arm. Tighten nuts to 9 foot-pounds.

4. Install upper control arm as described in Note 23b.

5. Lubricate the ball joint fitting until grease escapes between seal and steering knuckle, Fig. 3-37.

26. Lower Control Arm

NOTE: The lower control arm components are serviced as individual parts and are available at your Servicing Parts Warehouse.

a. Removal

1. Remove wheel disc.

2. Loosen wheel mounting nuts.

3. Remove hub cotter pin and loosen nut.

4. Raise car and place on jack stands.

5. Remove wheel and tire.

NOTE: Install one or two nuts to prevent drum from falling off of car.

6. Remove torsion bar adjusting bolt.

7. Remove hub nut and washer.

8. Remove brake line clip attached to frame.

9. Place a hydraulic jack under lower control arm.

10. Remove cotter pin, nut and brake line clip from upper spherical joint stud.

11. Using a hammer and drift remove upper spherical joint from steering knuckle.

12. Disconnect shock absorber at lower mount. Then work shock off mount.

13. Using Tie Rod End Puller, J-21930, disconnect tie rod end at steering knuckle.

14. Disconnect stabilizer bar and discard nut and bolt.

15. Using Ball Joint Puller, J-22292, and adapter, J-22292-3, disconnect lower spherical joint.

16. Disengage backing plate assembly from drive axle and secure assembly to the upper control arm with a piece of wire.

17. Remove lower control arm to frame attaching nuts.

NOTE: Do Not remove control arm to frame attaching bolts at this time.

18. Slowly let the hydraulic jack under the lower control arm down and position jack out of way.

NOTE: The torsion bar is now un-loaded and the lower control arm is hanging free.

19. Pull down on outer end of lower control arm with one hand, while reaching back with other hand to remove torsion bar adjusting nut from frame crossmember.

20. Remove lower control arm to frame attaching bolts.

21. Disengage lower control arm from frame mounts.

22. Using extreme care, slide lower control arm off of torsion bar.

NOTE: Protect torsion bar to prevent being damaged.

b. Installation

1. Lubricate end of torsion bar approximately 3" with E.P. chassis lubricant.

2. Lubricate torsion bar retainer on lower control arm and position control arm on torsion bar.

NOTE: When installing control arm, make sure that arm is installed in the on car position and is level. Also check torsion bar, making certain that torsion bar is fully seated in chassis crossmember.

3. Using a hydraulic jack, raise lower control arm into position and install in mounts in chassis. Do Not tighten nuts at this time.

4. Pull down on lower control arm with one hand, and with other hand install torsion bar lock nut through chassis crossmember and under arm.

5. Remove wire and install backing plate and knuckle assembly on drive axle.

6. Install lower control arm spherical joint into steering knuckle. Tighten nut to 40 foot pounds and install cotter pin.

7. Lift up upper control arm and install shock absorber on lower control arm mount. Tighten nut to 75 foot-pounds.

8. Install upper control arm spherical joint into steering knuckle.

9. Install brake line clip on upper spherical joint stud. Tighten nut to 40 foot-pounds and install cotter pin.

NOTE: Cotter pin must be crimped toward upper control arm to prevent interference with outer constant velocity joint seal.

10. Install brake line clip to chassis.

11. Install tie rod end in steering knuckle. Tighten nut to 30 foot pounds.

12. Lubricate torsion bar adjusting bolt with E.P. chassis lubricant and install in crossmember lock nut. Do Not tighten bolt at this time.

13. Install stabilizer bar as described in Note 31.

14. Install hub to drive axle washer and nut.

15. Remove nuts used to retain drum and install wheel and tire.

16. Raise car, remove jack stands and lower car.

17. Tighten hub to drive axle nut to 105 foot-pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

18. Tighten wheel nuts to 105 foot pounds.

19. Install wheel disc.

20. Adjust standing height as described in Note 34.

27. Lower Control Arm Bushings

a. Removal

1. Remove lower control arm as described in Note 26a.

2. Install tools as shown in Fig. 3-38, and press bushings out of control arm.

b. Installation

1. Install tools as shown in Fig. 3-39, and press bushings into lower control arm.

2. Install lower control arm as described in Note 26b.

3. Check standing height and adjust if necessary.

28. Lower Control Arm Spherical Joint

a. Removal

1. Remove lower control arm as described in Note 26a.

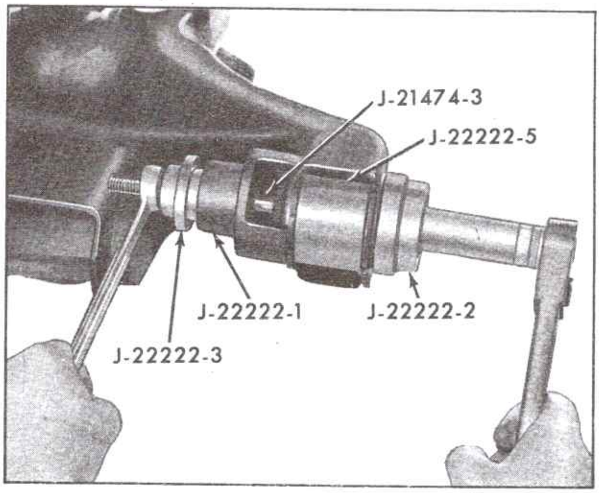


Fig. 3-38 Removing Lower Control Arm Bushings

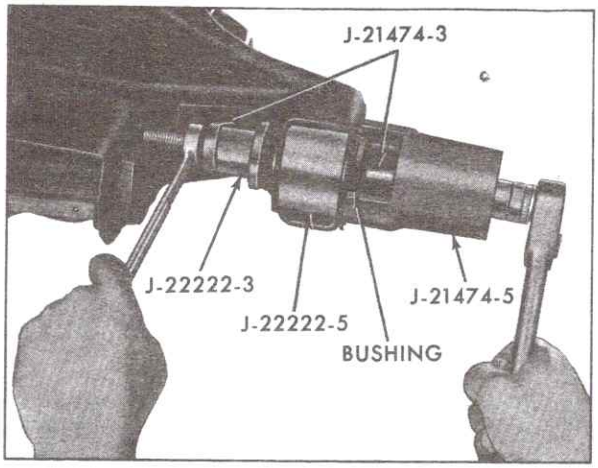


Fig. 3-39 Installing Lower Control Arm Bushings

2. Place lower control arm on its back on a work bench.

3. Using a chisel, cut two rivet heads off as shown in Fig. 3-40.

4. Place lower control arm right side up and grind large rivet head off as shown in Fig. 3-41.

5. Using a hammer and punch, drive on center rivet of joint until joint is out of control arm.

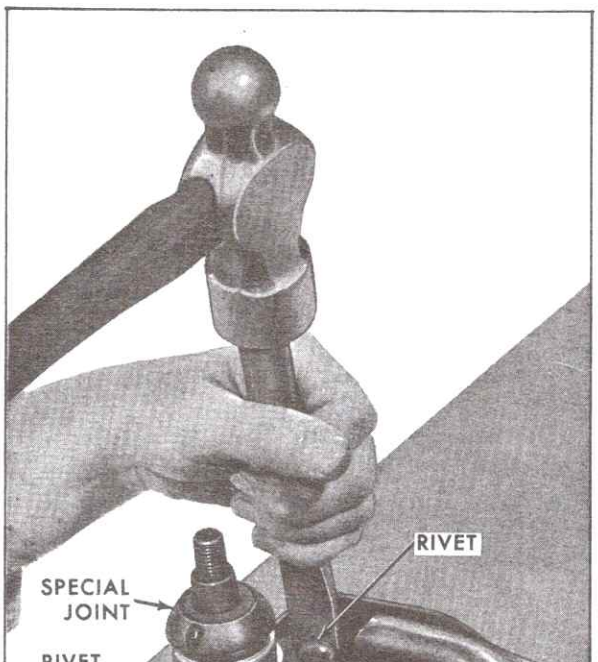


Fig. 3-40 Removing Lower Spherical Joint Rivets

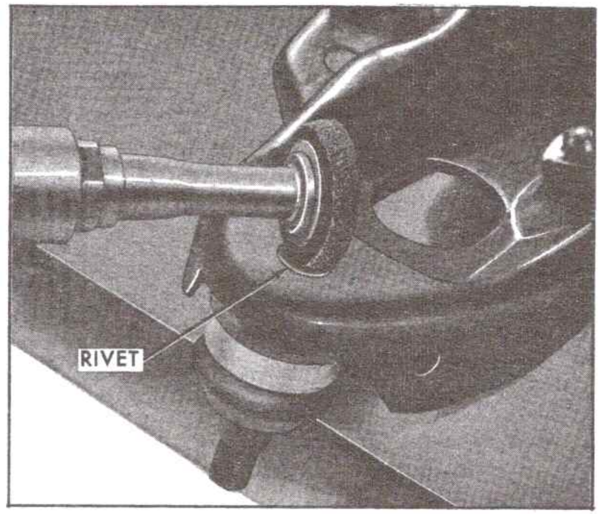


Fig. 3-41 Removing Lower Ball Joint Center Rivet

b. Installation

1. Install service ball joint into control arm and tighten bolts and nut as shown in Fig. 3-42.

2. Install lower control arm as described in Note 26b.

29. Lower Control Arm Spherical Joint Seal

The lower ball joint seal can be installed with the lower control arm either on or off the car.

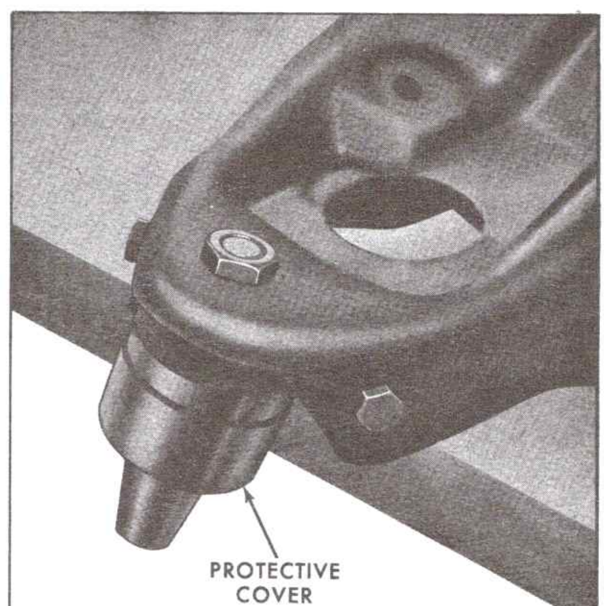


Fig. 3-42 Lower Spherical Joint Installed

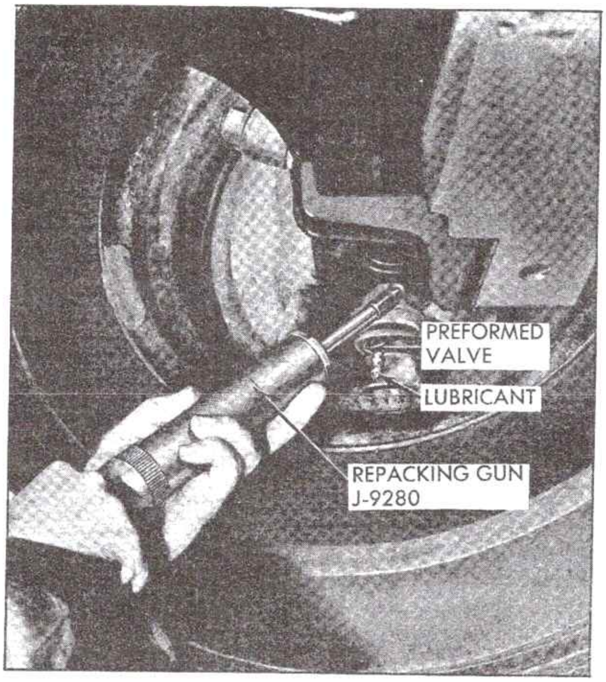


Fig. 3-43 Repacking Lower Spherical Joint (693)

a. Removal (On Car)

1. Remove steering knuckle as described in Note 20a.

2. Using a hammer, tap lightly on seal retainer.

3. Use a small screw driver and work retainer off of joint. Discard seal and retainer.

4. Wipe grease from ball joint and stud.

b. Installation

1. Position new seal over ball joint stud.

2. Lubricate jaws of Camber Adjusting Wrench, J-9231, slide jaw between seal and retainer.

3. Tap lightly with hammer on end of Camber Adjusting Wrench, J-9231, until seal retainer is fully seated.

4. Install steering knuckle as described in Note 20b.

5. Lubricate ball joint fitting until grease escapes from valve in side of seal as shown in Fig. 3-43.

30. Spherical Joint Checks

a. Vertical Checks

1. Raise car and position jack stands under lower control arms as near as possible to each ball joint. Car must be stable and should not rock on floor stands.

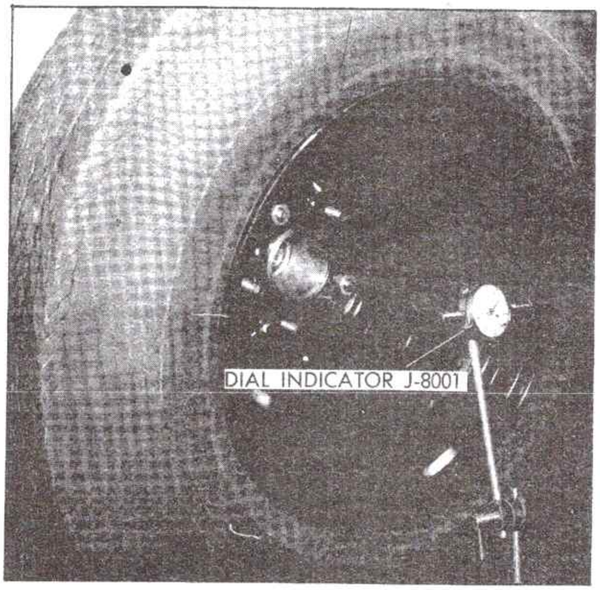


Fig. 3-44 Spherical Joint Horizontal Check

2. Clamp vice grips on end of drive axle and position dial indicator so that dial indicator ball rests on vice grip.

3. Place a pry bar between lower control arm and outer race and pry down on bar. Care must be used so that drive axle is not damaged. Reading must not exceed .125".

b. Horizontal Check

1. Raise car and position jack stands under lower control arms as near as possible to each ball joint.

2. Position dial indicator as shown in Fig. 3-44.

3. Grasp front wheel and push in on bottom of tire while pulling out at top. Read gauge, then reverse the push-pull procedure. Horizontal deflection on gage should not exceed .125" at wheel rim. This procedure checks both the upper and lower ball joints.

31. Stabilizer Bar

a. Removal

1. Place car on jack stands.

2. Remove link bolts, nuts, grommets, spacers and retainers from lower control arm. Discard bolts and nuts.

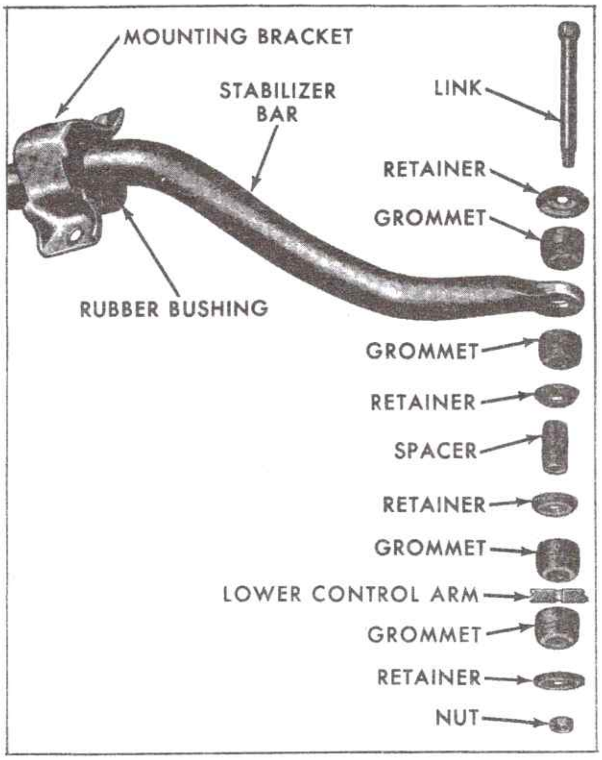


Fig. 3-45 Front Stabilizer Linkage

3. Remove bracket to chassis attaching bolts and remove stabilizer bar from car.

b. Installation

1. Position stabilizer bar in place on car.

2. Assemble grommets, spacers, and retainers on new link bolt as shown in Fig. 3-45.

3. Position link bolt on lower control arm, and install remaining grommet, retainer and nut.

4. Install stabilizer to chassis brackets.

NOTE: New link bolts are tightened to 14 foot-pounds, then cut off 1/4" from nut.

32. Front Shock Absorber

a. Removal

1. Remove wheel disc.

2. Loosen wheel mounting nuts.

3. Raise car and place on jack stands.

4. Remove wheel and tire.

NOTE: Install one or two nuts to prevent drum from falling off car.

5. Place a hydraulic jack under lower control arm near outer end.

6. Raise lower control arm just enough to take load off of shock absorber.

7. Disconnect shock absorber at upper and lower mount.

8. Compress shock absorber and work lower mount free from mount bolt.

9. Guide shock absorber down and toward rear of car, and remove from car.

b. Installation

1. Guide shock absorber up through upper control arm.

2. Position shock absorber on lower attaching bolt.

3. Extend upper shock absorber mount into frame attaching bracket.

4. Tighten shock absorber attaching nuts to 75 foot pounds.

5. Remove wheel mounting nuts and install wheel and tire.

6. Remove hydraulic jack.

7. Remove jack stands and lower car.

8. Tighten wheel mounting nuts to 105 foot pounds.

9. Install wheel disc.

33. Front End Alignment

NOTE: Standing height must be checked and adjusted if necessary before performing the front end alignment procedure.

Car must be on a level surface, gas tank full or a compensating weight added, front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Pressure Chart, Fig. 10-5. Both doors must be closed and no passengers or additional weight should be in car or trunk.

NOTE: Front end alignment must be performed in the exact sequence as described in this procedure. Wheel alignment equipment manufacturers provide detailed instructions for checking wheel alignment with their alignment

equipment. These instructions should be carefully followed.

In addition to the manufacturer's instructions, be sure to observe the following recommendations:

1. Align car on wheel alignment equipment.

2. Raise front end of car and check runout of both tires. Mark the spot where maximum runout occurs.

3. Place the maximum runout either to the front or rear. (This neutralizes the effect of runout on caster or camber). Lower front end of car.

4. Move bumper up and down several times to normalize the front suspension components.

5. Loosen nuts on inboard side of upper control arm cam bolts.

6. Check camber and adjust if necessary. Camber is adjusted by turning the upper control arm rear cam bolt, Fig. 3-45A. Camber should be -3/8 to + 3/8 with a preferred setting of 0.

7. Check caster and adjust if necessary. Caster should read -2°, ± 1/2°. Caster is adjusted by turning the upper control arm front and rear cam bolts, Fig. 3-45A. Wheels must be in straight ahead position. Use camber reading scale for making this adjustment.

NOTE: Caster reading from side to side of car should not exceed 1/2°.

a. Turn rear cam bolt so camber reading is 1/4° more than original setting for every 1° of caster change required for a correct reading. Turn to plus side of camber if caster is negative and to negative side of camber if caster is positive.

b. Turn front cam bolt so camber will return to its original setting.

c. Recheck caster reading. Caster should be -2° ± 1/2° with a preferred setting of -2°.

NOTE: If a problem occurs where there is not enough cam adjustment remaining to obtain correct reading:

1. Turn front cam bolt so high part of cam is pointing up.

2. Turn rear cam bolt so high part of cam is pointing down.

This is a location to start from and a correct reading can be obtained with the above procedure.

3. Tighten upper control arm cam nuts to 75 foot-pounds. Hold head of bolt securely; any movement of the cam will affect final setting and will require a recheck of the caster and camber adjustments.

8. Toe-in should be 0 inch to 1/8 inch with a preferred setting of 1/16".

NOTE: Toe-in is adjusted by turning the tie-rod adjuster tubes at outer ends of each tie rod after loosening clamp bolts. The readings should be taken only when the front wheels are in a straight ahead position and with steering gear on its high spot.

a. Center steering wheel, raise car and check wheel runout as described in Section 10, Note 2d.

b. Loosen tie-rod adjuster nuts and adjust tie-rods to obtain 0 inch to 1/8 inch toe-in setting.

c. Tighten tie-rod adjuster nuts to 20 foot-pounds.

d. Position tie-rod adjuster clamps so that opening of clamps are facing up. Interference with front suspension components could occur while turning if clamps are facing down.

FRONT END ALIGNMENT (693 Only)				
Preferred				Variation
Caster	-2°	Left and Right		± 1/2°
Camber	0°	Left and Right		± 3/8°
Toe-in	1/16"			± 1/16"
Turning radius (curb to curb)				20' 8"
Outside wheel angle with inside wheel at 20° is				18° 10'

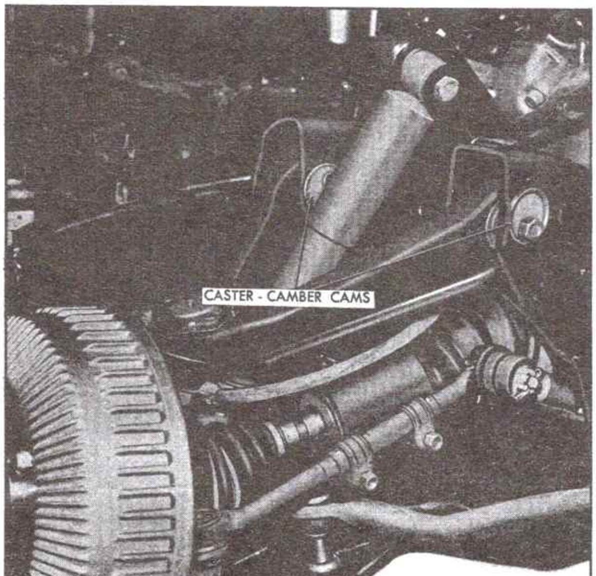


Fig. 3-45A Caster, Camber Cam Locations

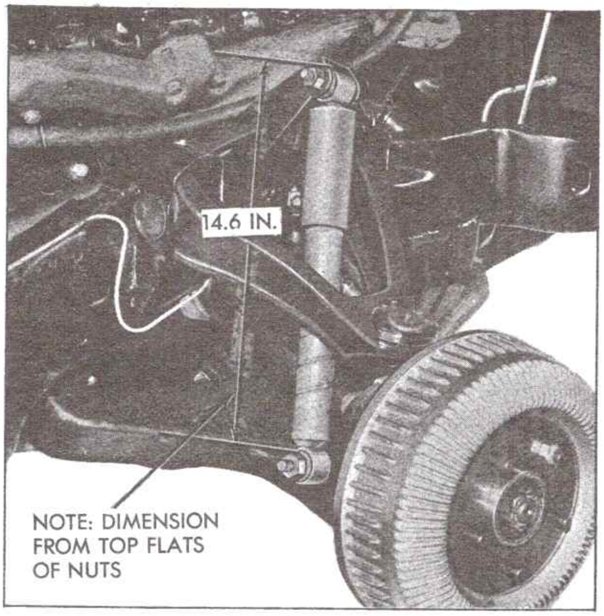


Fig. 3-46 Checking Standing Height

34. Standing Height Adjustment

The standing height must be checked, and adjusted if necessary before performing the front end alignment procedure. The standing height is controlled by the adjustment setting of the torsion bar adjusting bolt. Clockwise rotation of the bolt increases the front height; counterclockwise decreases the front height.

To obtain a front standing height reading, measure from the center line of the front wheel toward the rear of car, 37 1/2 inches. At this point, measure from the under side of the frame to the ground. This dimension should be 6.28 inches.

To obtain a rear standing height reading, measure from the center line of the rear wheel toward the front of car, 16 1/2 inches. At this point, measure from the under side of the frame to the ground. This dimension should be 6.18 inches.

Frame to ground dimensions must be within 1 inch from front to rear and within 5/8 inches from side to side.

If dimensions are not within tolerance, adjust torsion bar.

Another method for checking front standing height is to measure from the top of the upper shock mount bolt to the top of the lower shock mount bolt. This dimension should read 14.6" as shown in Fig. 3-46.

DRIVE AXLES

GENERAL DESCRIPTION

Drive axles on the 1967 Fleetwood Eldorado (693 series), Fig. 3-47, are a complete flexible assembly, consisting of an axle shaft with a ball-type constant velocity joint at the outboard end and a tri-pot type constant velocity joint at the inboard end. The torsional damper is not serviceable and must be replaced as a unit.

The inboard tri-pot joint is not only flexible to operate at various angles, but can also move in and out (shorten and lengthen) as required by the suspension while it travels through its ride motion.

NOTE: Whenever any operations call for disconnecting, connecting, removal, or installation of the drive axles, extreme care must be exercised to prevent damage to the seals. When performing these operations, install a short length of rubber hose on the lower control arm torsion bar connector to prevent drive axle seals from being damaged.

CAUTION: When removing or installing the right hand drive axle, be sure to disconnect the negative battery cable. It is possible to short out the starter motor by making contact between the wrench and the starter motor terminals.

35. Drive Axles

a. Removal

1. Disconnect the negative battery cable when removing the right drive axle.

2. Raise front end of car and place jack stands under the lower control arms near the outboard end.

3. Remove wheel disc, wheel and tire.

NOTE: Install one or two nuts to prevent drum from falling off of car.

4. While a helper applies the brakes, remove the hub cotter pin, nut and washer.

5. Using a block of wood and a hammer, tap on end of axle to un-seat axle at hub assembly.

NOTE: Install a short piece of rubber hose on the lower control arm torsion bar connector as shown in Fig. 3-48 to prevent damage to the drive axle seals when removing or installing the drive axles.

6. Remove six drive axle to output shaft screws.

NOTE: Have helper apply brakes to prevent drive axles from turning while removing screws.

7. Disconnect tie rod end at steering knuckle, using Tie Rod End Puller, J-21930.

8. Remove brake line clip attached to the frame.

9. Disconnect upper ball joint.

NOTE: Using a brass drift and hammer, drive on knuckle until upper ball joint stud is free. Use extreme care to prevent damage to brake line when separating ball joint from steering knuckle.

10. Turn backing plate and steering knuckle assembly to obtain maximum clearance.

11. Slide drive axle inward, and disengage outer joint from steering knuckle.

12. Rotate drive axle toward the rear of car, and guide drive axle down and out of car.

b. Installation

1. Install a short piece of rubber hose on lower control arm torsion bar connector to prevent damage to drive axle seals when installing drive axle.

2. Turn backing plate and steering knuckle assembly to obtain maximum clearance.

3. Guide drive axle in from under side of car. Place drive axle in position by lifting up and sliding over lower control arm.

CAUTION: Use extreme care to prevent damage to seals when installing drive axle.

4. Insert axle splines into steering knuckle.

5. Install upper ball joing into steering knuckle.

6. Install brake line clip on upper ball joint stud. Install and tighten nut to 40 foot pounds and install cotter pin.

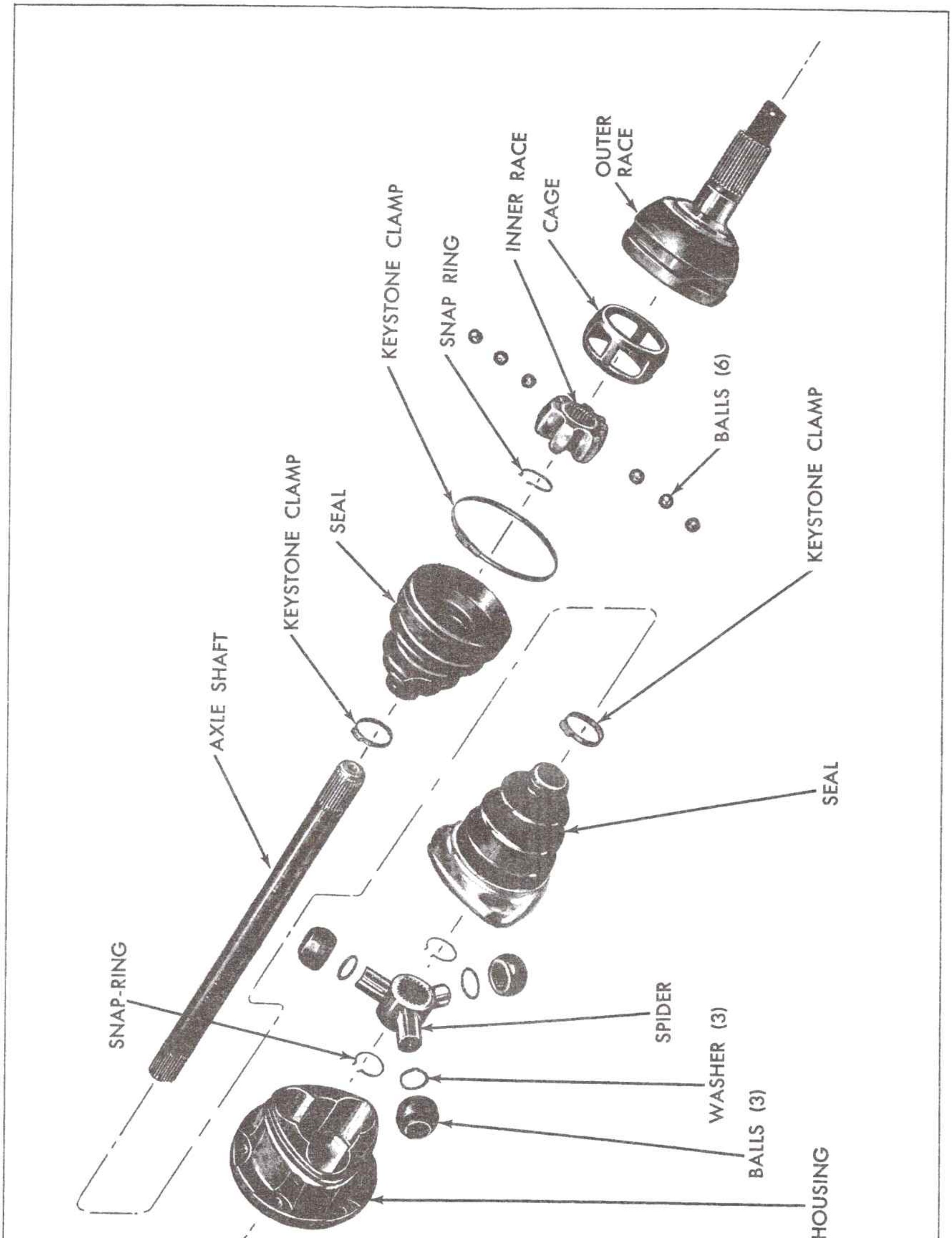


Fig. 3-47 Drive Axle Disassembled

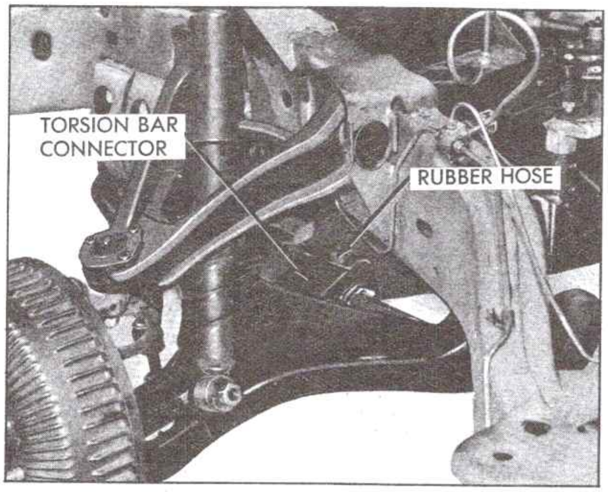


Fig. 3-48 Rubber Hose Location

CAUTION: Use extreme care to prevent damage to brake line. If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.

7. Install brake line clip on frame.

8. Install six drive axle-to-output shaft screws and washers. Tighten screws to 65 foot pounds.

NOTE: Have helper apply brakes to prevent axle from turning when installing screws.

9. Install tie rod end on steering knuckle. Tighten nut to 30 foot pounds.

NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.

10. Install washer and nut on outboard end of axle shaft. Have helper apply brakes and tighten nut to 105 foot pounds and install cotter pin.

NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.

11. Remove piece of rubber hose from lower control arm torsion bar connector.

12. Remove two nuts, and install wheel and tire. Install wheel nuts and tighten to 105 foot pounds.

13. Install wheel disc.

14. Remove jack stands and lower car.

15. If right drive axle was installed, connect negative battery cable.

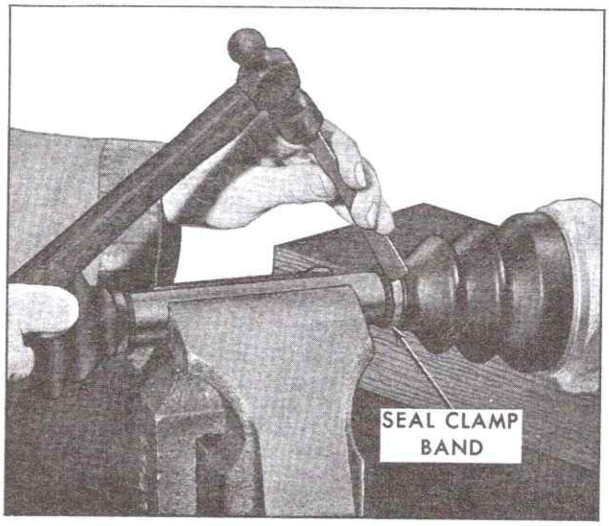


Fig. 3-49 Removing Seal Bands

36. Outer Constant Velocity Joint (Ball Type)

The outer constant velocity joints are replaced as an assembly and are disassembled for repacking and replacement of seals only.

a. Disassembly

1. Insert axle assembly in vise. Clamp on mid-portion of axle shaft.

2. Remove inner and outer seal band clamps as shown in Fig. 3-49.

3. Slide seal down axle shaft to gain access to the constant velocity joint.

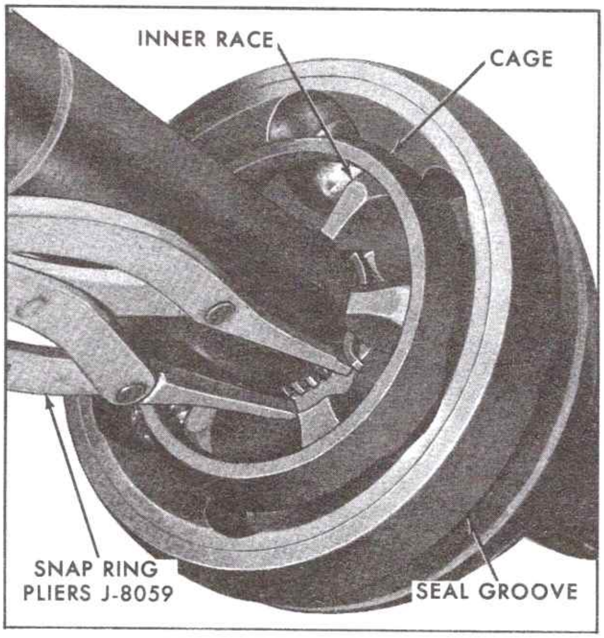


Fig. 3-50 Removing Outer Joint from Axle

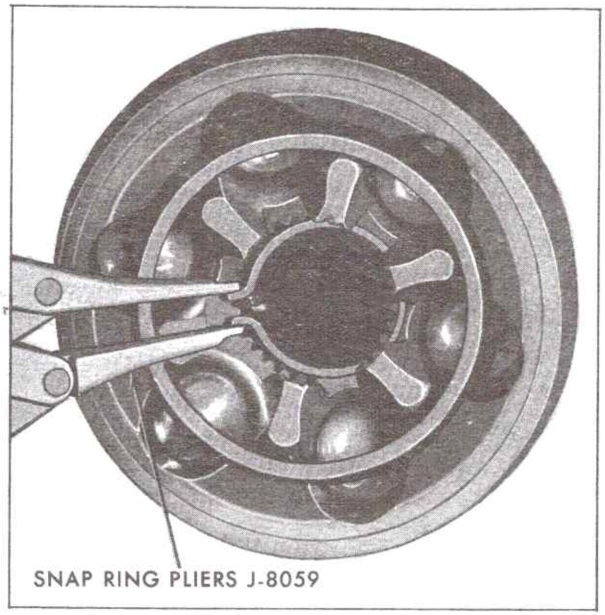


Fig. 3-51 Removing Inner Race Snap Ring

NOTE: Wipe excess grease from joint to permit access to the snap ring.

4. Using Snap Ring Pliers, J-8059, spread snap ring and slide joint off axle spline as shown in Fig. 3-50.

5. Remove inner race snap ring as shown in Fig. 3-51.

6. Slide seal off axle shaft.

7. To remove the balls, hold the constant velocity joint with one hand, then tilt cage and inner race as shown in Fig. 3-52, so that one ball can be removed. Continue until all six balls are removed.

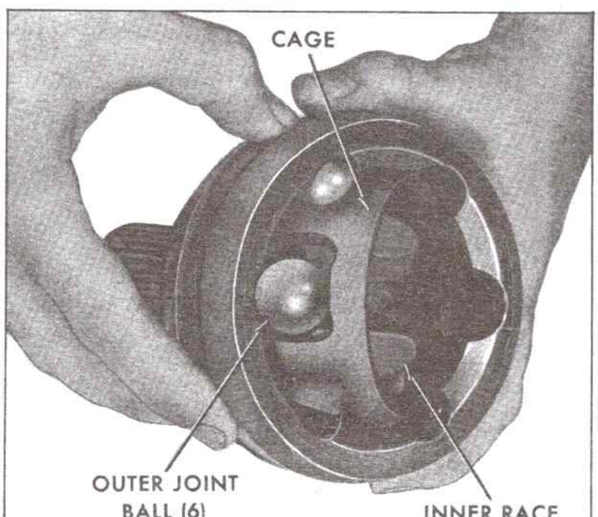


Fig. 3-52 Removing Balls from Outer Joint

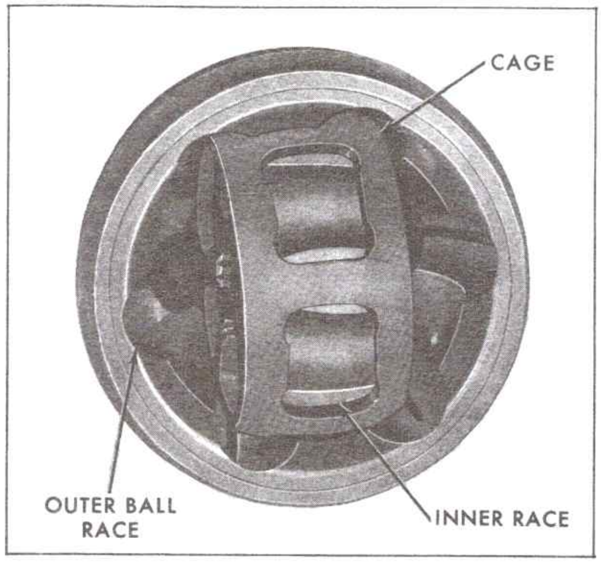


Fig. 3-53 Removing Cage and Inner Race

8. Turn cage 90° as shown in Fig. 3-53, with slot in cage aligned with short land on outer race and lift cage out with inner race.

9. Turn short land of inner race 90° in line with hole in cage. Lift land on inner race up through hole in cage, then turn up and out to separate parts as shown in Fig. 3-54.

b. Cleaning and Inspection (Outer Joint)

Wash all parts thoroughly in a cleaning solvent and dry with compressed air. Inspect rubber seals for damage or wear. If seals are damaged or worn, replace with new seals.

1. Inspect outer race housing splines and threads for any damage.

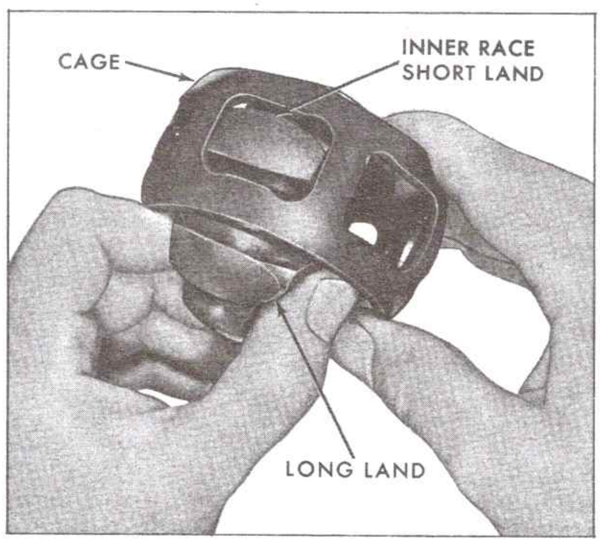


Fig. 3-54 Removing Inner Race from Cage

2. Inspect balls (six) for nicks, cracks, scores or wear.

3. Inspect cage for cracks or wear.

4. Inspect inner race for excessive wear, scores or cracks.

5. Inspect snap ring.

NOTE: If any of the first four defects are found, the constant velocity joint assembly must be replaced as a unit.

c. Assembly

1. Insert short land of inner race into slot in cage and pivot to install in cage as shown in Fig. 3-54.

2. Pack constant velocity joint with special drive axle joint lubricant, available from servicing Parts Warehouses.

3. Align inner race as shown in Fig. 3-53,and pivot inner race 90° to align in outer race as shown in Fig. 3-51.

4. Apply lubricant to the inner and outer race and insert balls into outer race one at a time as shown in Fig. 3-52, until all six balls are installed.

NOTE: Inner race and cage will have to be tilted as shown so that each ball can be inserted.

5. Place small keystone clamp on axle shaft.

6. Position seal in groove on axle shaft and secure small keystone clamp as shown in Fig. 3-55.

7. Pack inside of seal with special drive axle joint lubricant until folds of seal are full.

8. Install snap ring into inner race as shown in Fig. 3-51.

9. Insert axle shaft into splines of outer constant velocity joint until snap ring secures shaft.

NOTE: Snap ring must be spread to facilitate mating of axle shaft into splines of outer constant velocity joint.

10. Position seal in groove of outer race.

NOTE: Mating area of seal and outer race must be free of lubricant to obtain proper sealing.

11. Install large keystone clamp over seal and secure as shown in Fig. 3-55.

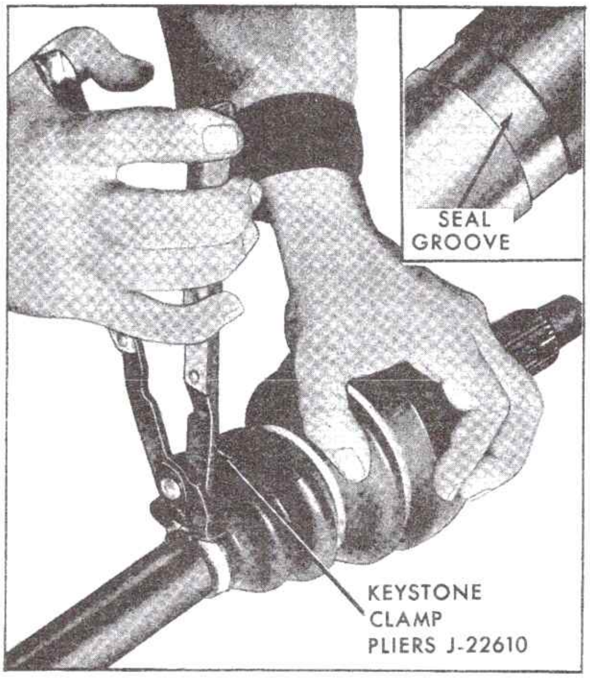


Fig. 3-55 Positioning Seal on Axle Shaft

37. Inner Constant Velocity Joint (Tri-pot Type)

The inner constant velocity joints are disassembled for repacking and replacement of the spider components and seals.

a. Disassembly

1. Insert axle assembly in a vise. Clamp on mid-portion of axle shaft.

2. Remove small seal band clamp as shown in Fig. 3-49.

3. Remove large end of seal from the joint housing by prying up crimped edge on seal adapter. Next, drive the seal adapter and seal off of the joint housing with a hammer and chisel as shown in Fig. 3-56.

4. Slide seal and adapter down the axle shaft until the tri-pot joint is exposed.

CAUTION: The tri-pot housing is now free to slide off of the joint. Extreme care must be used to prevent the spider leg balls from sliding off the spider legs. Each leg ball contains several spider needles.

5. Cup one hand under the tri-pot joint to prevent dropping spider leg balls while sliding housing off of joint.

6. Remove spider leg balls.

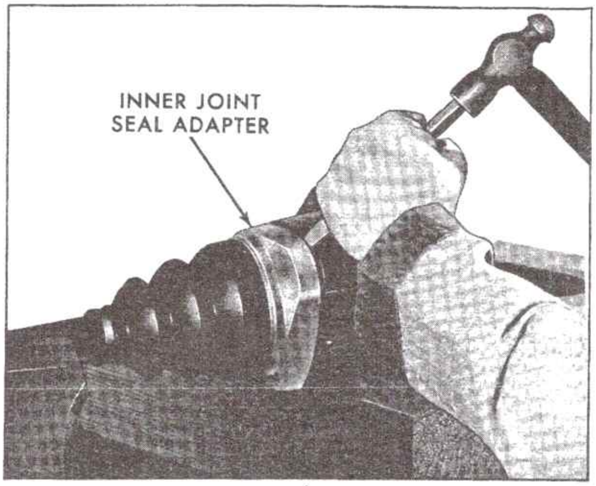


Fig. 3-56 Removing Seal Adapter from Joint Housing

NOTE: To prevent dropping or disengaging spider needles, remove each washer and spider leg ball as a unit, Fig. 3-57.

7. Remove O-ring seal from outer housing.

8. Wipe excess grease from end of axle shaft to gain access to snap ring and remove spider outer snap ring as shown in Fig. 3-58.

9. Using a plastic mallet, tap alternately on spider legs and drive spider off shaft.

10. Remove spider inner snap ring.

11. Slide seal off axle shaft.

12. Remove needles from spider leg balls.

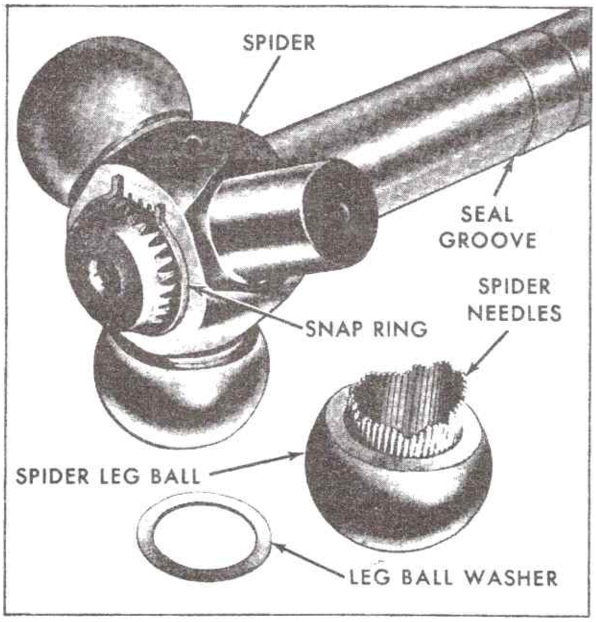


Fig. 3-57 Spider Assembly

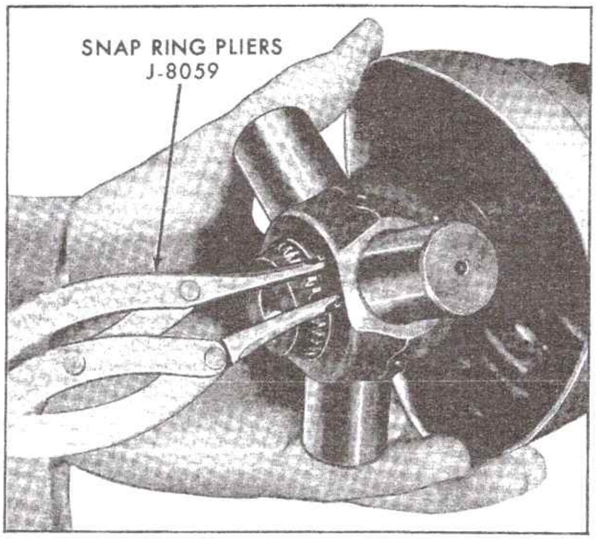


Fig. 3-58 Removing Spider Snap Ring

b. Cleaning and Inspection (Inner Joint)

Wash all parts thoroughly in a cleaning solvent and dry with compressed air. Inspect rubber seal and O-ring for damage or wear. If seal or O-ring is damaged or worn, replace with a new O-ring or seal.

1. Inspect seal adapter band for being bent or cracked.

2. Inspect tri-pot housing for excessive wear or chipped ball races and cracks in housing.

3. Inspect snap rings for distortion or damage.

4. Inspect spider leg balls for excessive wear, nicks, or scores.

5. Inspect spider leg ball needles for wear or chips and breaks.

6. Inspect spider for excessive wear, scores or cracks.

c. Assembly

1. Insert axle assembly in a vise. Clamp on mid-portion of axle shaft.

2. Place small keystone clamp on axle shaft.

3. Position seal on axle shaft.

4. Place spider inner snap ring in position on axle shaft.

5. Apply lubricant to the axle and the spider splines.

6. Align spider on axle shaft.

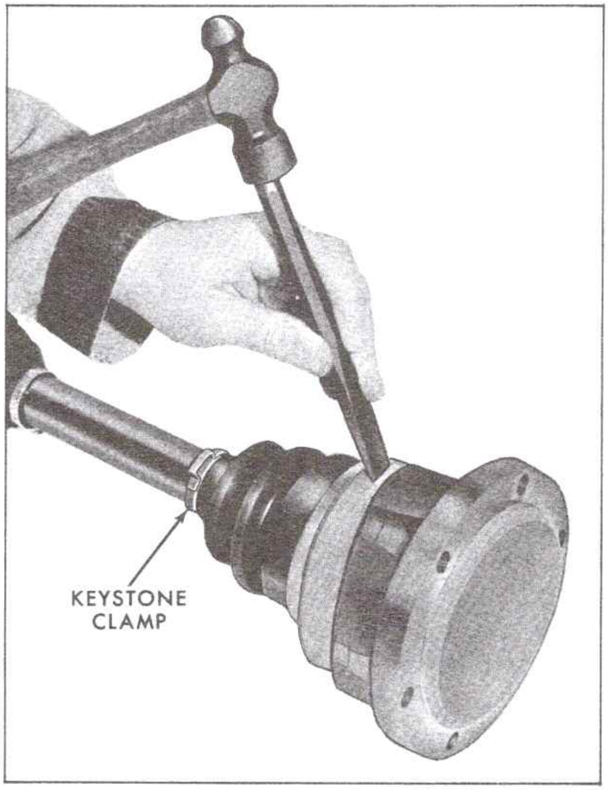


Fig. 3-59 Installing Seal Adapter on Joint Housing

7. Using a plastic mallet, tap alternately on spider legs and drive spider into position on axle shaft.

8. Install spider outer snap ring on axle shaft.

9. Place O-ring on tri-pot joint housing.

10. Apply a thin coat of lubricant to inner race on leg balls, and install leg ball needles.

11. Apply lubricant to spider leg balls and legs.

12. Remove axle from vise then install washers and three spider leg balls, one at a time as a unit on spider.

CAUTION: When installing leg balls, use the leg ball washers as retainers for the spider needles.

13. Pack inside of seal with special drive axle joint lubricant, (available from servicing Parts Warehouses) until folds of seal are full.

14. Pack housing with special drive axle joint lubricant and install by sliding housing over spider leg balls.

15. Position seal adapter over lip on joint housing and stake as shown in Fig. 3-59.

NOTE: Mating area of seal adapter and joint housing must be free of lubricant to obtain proper mating and sealing.

16. Seat seal in groove on axle shaft, and secure keystone clamps as shown in Fig. 3-55.

OUTPUT SHAFT

GENERAL DESCRIPTION

Torque from the final drive is transmitted to right and left output shafts which connect to drive axles. The right output shaft is splined to the sun gear while the left output shaft is splined to the planet pinion carrier.

38. Right Hand Output Shaft (Fig. 3-60)

a. Removal

1. Disconnect negative battery cable.

2. Remove wheel disc and loosen wheel mounting nuts.

3. Raise car and place on jack stands.

4. Remove wheel mounting nuts and remove wheel and tire.

NOTE: Install one or two wheel mounting nuts to prevent drum from falling off of car.

5. Install a short length of rubber hose on lower control arm torsion bar connector as shown in Fig. 3-48.

6. Remove six drive axle to output shaft screws.

NOTE: When performing step 6, it will be necessary to have a helper apply the brakes to prevent the drive axle from turning.

7. Disconnect battery cable clip on output shaft support.

8. Remove two output shaft support to engine bolts and one support to strut bolt.

9. Loosen shock absorber lower mount nut.

10. Rotate inboard end of drive axle rearward toward starter motor.

11. Slide output shaft straight out toward side of car. When splined end of shaft is out of final drive unit, lower splined end and remove from under side of car.

CAUTION: Extreme care must be taken to protect final drive oil seal surface on output shaft from nicks and scratches.

b. Installation

1. Install output shaft from under side of car by lifting up and sliding toward side of car.

CAUTION: Extreme care must be exercised to prevent output shaft support from damaging battery cable.

2. Apply clean front wheel bearing grease between lips of output shaft seal, then install output shaft into final drive, indexing splines of output shaft with final drive.

3. Install two support to engine bolts and washers. Tighten bolts to 50 foot-pounds.

NOTE: Seat washers in old grooves in support to obtain proper alignment of output shaft.

4. Install bolt, support to final drive strut.

5. Install battery cable clip on output shaft support.

6. Rotate drive axle toward front of car and into position.

7. Install six drive axle to output shaft screws. Tighten screws to 65 foot-pounds.

NOTE: Have a helper apply the brakes to prevent the drive axle from turning when performing step 7.

8. Tighten shock absorber lower mount nut to 75 foot-pounds.

9. Install wheel and tire.

NOTE: Do not tighten wheel mounting nuts at this time.

10. Raise car, remove jack stands and lower car.

11. Tighten wheel mounting nuts to 105 foot-pounds.

12. Install wheel disc.

13. Connect negative battery cable.

14. Check final drive oil level and check for oil leaks at output shaft.

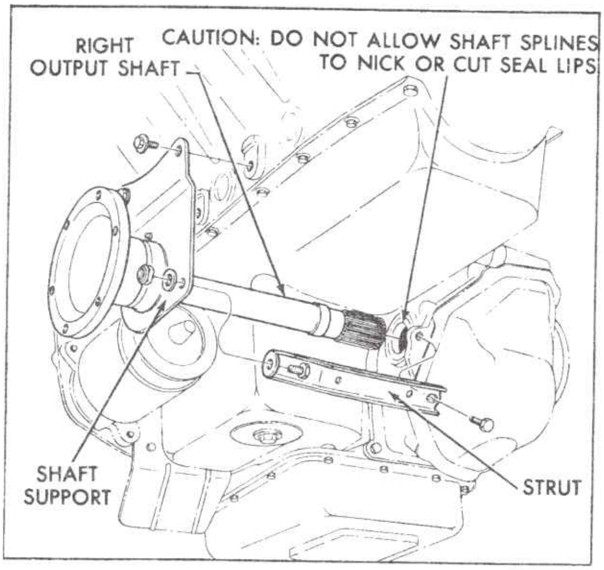


Fig. 3-60 Right Hand Output Shaft

39. Right Hand Output Shaft Bearing

a. Removal

1. Remove output shaft as described in Note 38a.

2. Remove three output shaft bearing retainer to support bolts.

3. Clamp output shaft in a vise as shown in Fig. 3-61.

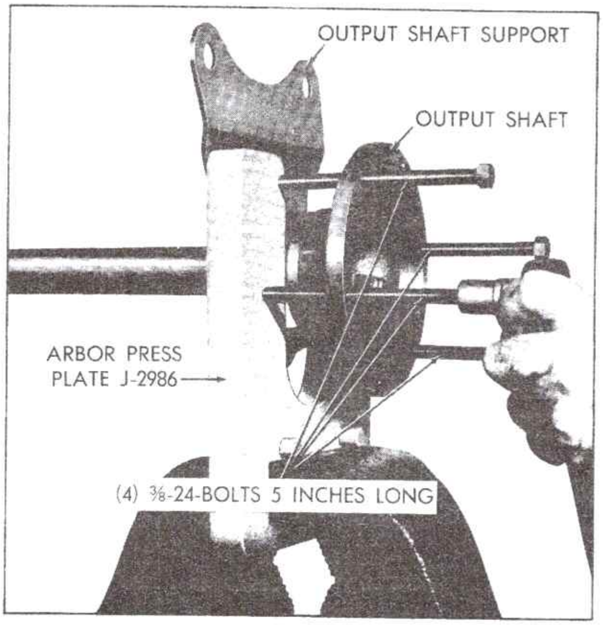


Fig. 3-61 Removing Right Hand Output Shaft Support and Bearing

CAUTION: Use extreme care to prevent damage to seal surface on output shaft.

4. Install Rear Wheel Bearing Plate and Pin Assembly, J-2986-1, and four 3/8-24 bolts, five inches long on output shaft, Fig. 3-61.

5. Remove bearing assembly by tightening bolts alternately.

b. Installation

1. Position output shaft on flange end on a work bench, Fig. 3-62.

2. Lubricate output shaft support and install over splined end of output shaft.

3. Lubricate bearing and install, using a hammer and Bearing Installer, J-22609, Fig. 3-62.

4. Lubricate exposed face of bearing and install bearing retainer. Secure bearing retainer with three bolts.

5. Using a hammer and Bearing Installer, J-22609, install slinger as shown in Fig. 3-63.

6. Install output shaft as described in Note 38b.

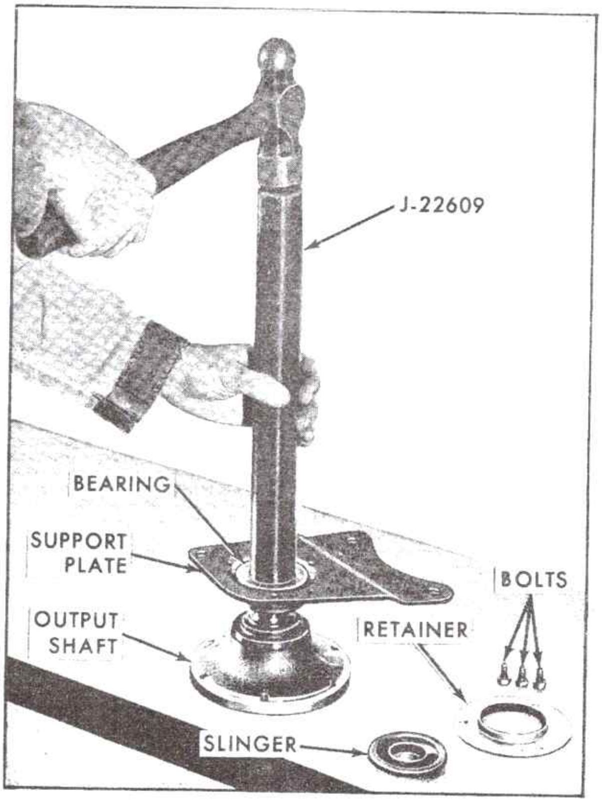


Fig. 3-62 Installing Right Hand Output Shaft Support and Bearing

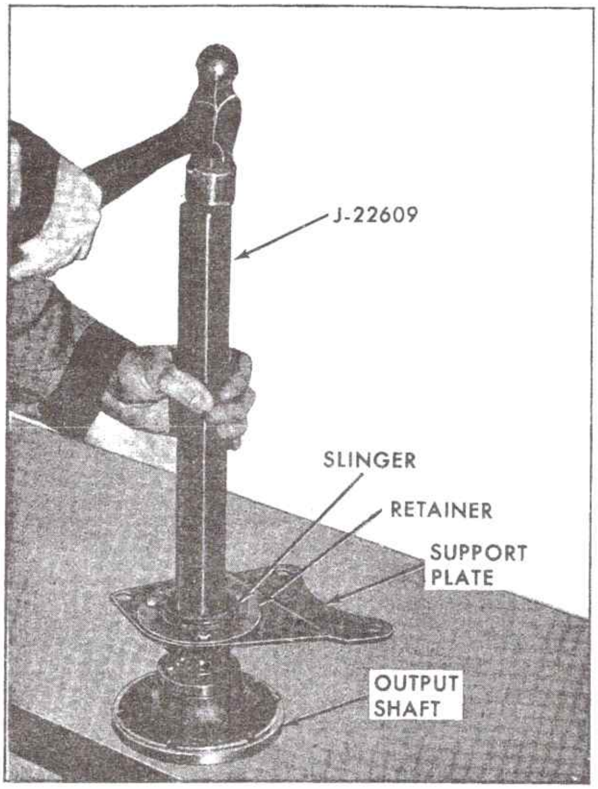


Fig. 3-63 Installing Right Hand Output Shaft Support Slinger

40. Left Hand Output Shaft

a. Removal

NOTE: The right hand output shaft must be removed to permit access to the left hand output shaft retaining bolt.

1. Disconnect negative battery cable.

2. Remove wheel discs.

3. Loosen wheel mounting nuts.

4. Raise car and place on jack stands.

5. Remove both wheel mounting nuts, wheels and tires.

NOTE: Install one or two wheel mounting nuts to prevent drums from falling off car.

6. Remove right hand output shaft as described in Note 38a.

7. Remove left drive axle as described in Note 35a.

8. Insert a 9/16" socket on an extension into final drive unit from right hand output shaft side, and remove left hand output shaft retaining bolt.

9. Remove output shaft by pulling straight out toward side of car. After splined end of output shaft clears final drive unit, lower splined end and remove output shaft from under car.

CAUTION: Use extreme care when removing output shaft to protect oil seal surface on output shaft from nicks and scratches.

b. Installation

1. Apply clean wheel bearing grease between lips of final drive output shaft seal.

2. Install output shaft from under side of car.

CAUTION: Use extreme care when indexing output shaft splines with splines in final drive unit to prevent damage to the splines. Care must be used to prevent dislodging axle retainer washer located in the final drive unit.

3. Insert a 9/16" socket on an extension into the final drive unit from the right hand output shaft side, and install left hand output shaft retaining bolt. Tighten bolt to 45 foot-pounds.

4. Install left drive axle as described in Note 35b.

5. Install right hand output shaft as described in Note 38b.

6. Remove wheel mounting nuts used to prevent drums from falling off car.

7. Install wheels and tires.

NOTE: Do not tighten wheel mounting nuts at this time.

8. Raise car, remove jack stands and lower car.

9. Tighten wheel mounting nuts to 105 foot-pounds.

10. Install wheel discs.

11. Connect negative battery cable.

12. Check final drive oil level and check for oil leaks at output shafts.

41. Output Shaft Seal Replacement

a. Removal

1. To replace right output shaft seal, remove right output shaft as described in Note 39a. Then remove seal from final drive unit with a pry bar and discard seal.

CAUTION: When removing seal, use extreme care to prevent damaging seal surface in final drive unit.

2. To replace left output shaft seal, remove left output shaft as described in Note 40a. Then remove seal from final drive unit with a pry bar and discard seal.

CAUTION: When removing seal, use extreme care to prevent damaging seal surface in final drive unit.

b. Installation

1. To install right hand output shaft seal in final drive, attach Universal Handle, J-8092, to Seal Installer, J-22198. Then place seal in final drive unit and drive on Universal Handle, J-8092, until seal is installed. Apply clean front wheel bearing grease between lips of seal.

CAUTION: Rotate tools to maintain proper alignment when installing seal.

2. To install left hand output shaft seal in final drive, attach Universal Handle, J-8092, to Seal Installer, J-22199. Then place seal in final drive unit and drive on Universal Handle, J-8092, until seal is installed.

3. Install left hand output shaft as described in Note 40b.

4. Install right hand output shaft as described in Note 39b.

FINAL DRIVE

GENERAL DESCRIPTION

The final drive assembly is mounted and splined directly to the transmission. The final drive consists of a pinion drive gear, a ring gear and a planetary gear train.

The planetary gear train consists of a planet pinion carrier with three pair of planet pinions, a sun gear and an internal gear. This gear train performs the same function as the side gears and pinion gears in a conventional differential.

The lubricant level for the final drive unit should be checked at each oil change period. Maintain lubricant level to filler plug hole in cover.

Always clean dirt or foreign material from around plug opening before removing filler plug.

Periodic or seasonal lubricant changes are not recommended.

42. Final Drive

The final drive unit is not serviced, but is replaced as a unit with the exception of the various seals. Those seals that are serviced are: the pinion oil seals, output shaft seals, pinion bearing housing O-ring, and the vent pin seal.

NOTE: On some early model Fleetwood Eldorados it will be necessary to reset the pinion bearing pre-load if the pinion bearing oil seals are replaced. The pinion bearing pre-load procedure will be published at a later date.

a. Removal

1. Raise hood and disconnect negative battery cable.

2. Remove bolt securing transmission filler tube bracket to final drive case and remove filler tube.

3. Disconnect transmission oil cooler lines at transmission and at radiator.

4. Remove bolt securing transmission oil cooler lines clamp on left side of engine and position oil cooler lines between governor assembly and left wheel housing.

CAUTION: Use extreme care when moving oil cooler lines so as not to kink lines.

5. Remove bolts "A" and "B" and nut "H" securing upper part of final drive case to transmission case, Fig. 3-64.

NOTE: The use of a box end wrench with a crescent shaped handle will facilitate the removal of nut "H".

6. Raise car and place on jack stands under front frame horns and under frame side rails.

7. Install a short length of heater hose on both lower control arm torsion bar connectors.

8. While helper alternately applies and releases service brakes, loosen twelve screws, six each side, securing left and right drive axles to output shafts.

9. Remove six screws securing right drive axle to output shaft.

10. Loosen lower nut securing right shock absorber to lower control arm.

NOTE: DO NOT remove nut.

11. Remove two nuts, bolts and washers securing strut from final drive case to right hand output shaft support and remove strut.

12. Remove battery cable clip on right hand output shaft support.

13. Remove two bolts securing right hand output shaft support to engine.

14. Rotate drive axle rearward toward starter motor to gain access to output shaft.

15. Remove right hand output shaft by sliding straight out toward side of car. When splined end of shaft is clear of final drive unit, lower splined end and remove output shaft from under side of car.

CAUTION: Extreme care must be used when removing output shafts to protect seal surface on shaft from nicks and scratches.

16. Remove six screws securing left hand drive axle to output shaft.

17. Loosen eight screws securing final drive cover to final drive and allow lubricant to drain.

18. Remove eight screws securing final drive cover to final drive and remove cover.

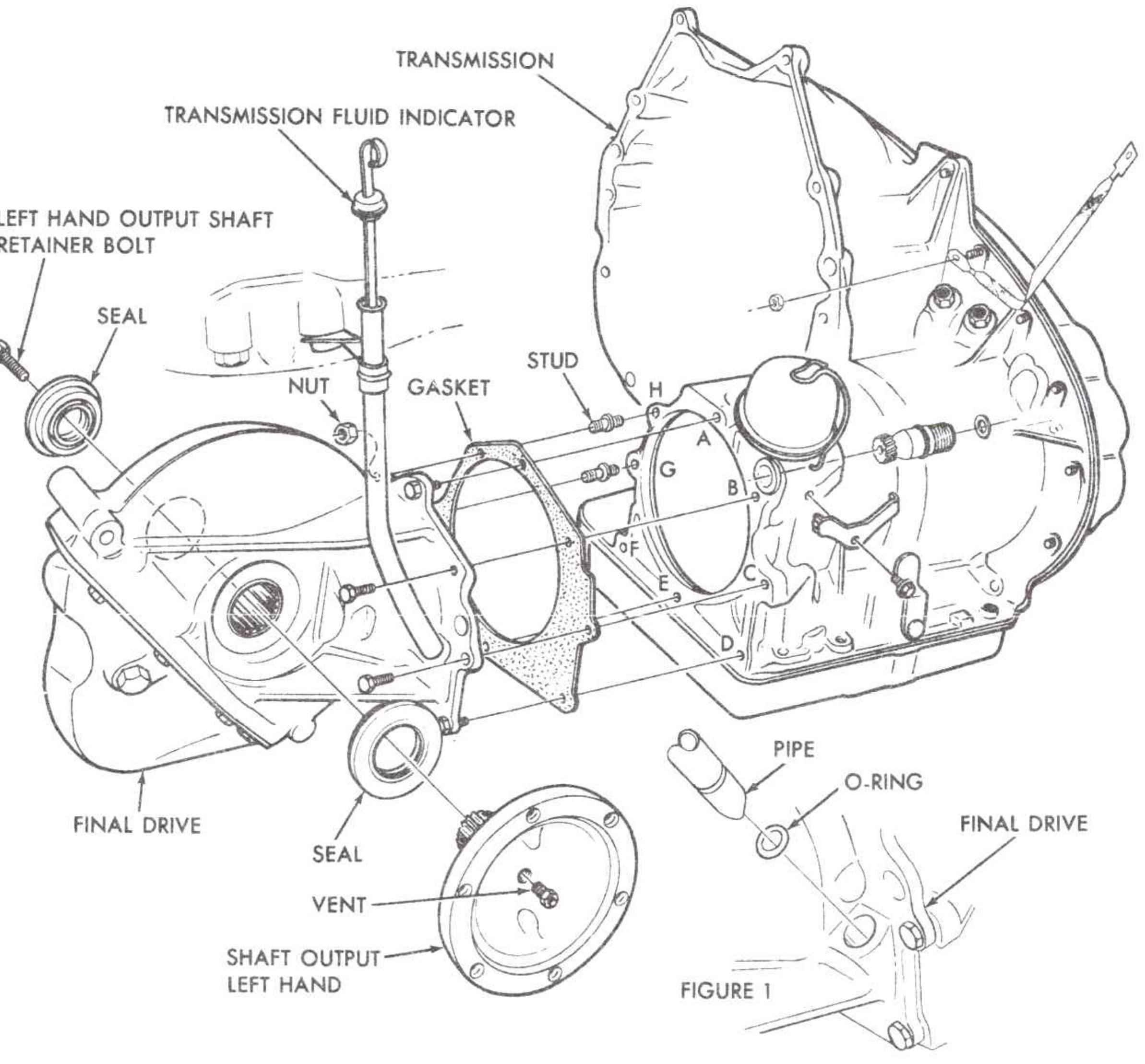


Fig. 3-64 Final Drive Attachment

19. Remove nut and bolt securing final drive to support bracket.

20. Remove two bolts securing final drive support bracket to engine and remove support bracket.

21. Install a differential holding fixture on a transmission jack. Then position jack under car so that the final drive unit can be attached to the differential holding fixture.

22. Remove bolts "C", "D", "E", "F" and nut "G" securing final drive case to transmission case, Fig. 3-64.

23. Move transmission jack toward front of car to disengage final drive splines from transmission.

NOTE: Transmission fluid will drain when final drive unit is separated from transmission. Provide a container to catch the oil.

24. Lower transmission jack and remove final drive unit from car, then remove final drive unit from jack.

25. Remove transmission to final drive gasket and discard gasket.

b. Installation

1. Position final drive unit in differential holding fixture attached to transmission jack.

2. Apply transmission fluid on the transmission side of a new final drive to transmission gasket, then position gasket on transmission.

3. Raise transmission lift. Align the two bolt studs "G" and "H" on the transmission with their mating holes in the final drive. Move final drive until it mates with the transmission.

NOTE: It may be necessary to rotate the left output shaft so that the splines on the final drive pinion engage the splines of the transmission output shaft. Do not allow gasket to become mispositioned when engaging splines.

4. Install bolts "C", "D", "E", "F" and nut "G" finger tight.

5. Position final drive support bracket to engine and final drive and install two bolts and nuts securing bracket to engine. Tighten bolts to 50 foot-pounds.

6. Install nut and bolt securing final drive to final drive support bracket. Tighten bolt to 75 foot-pounds.

7. Tighten bolts "C", "D", "E", "F" and nut "G" to 25 foot-pounds.

8. Position left hand drive axle and install six drive axle to output shaft screws. Tighten screws to 65 foot-pounds.

NOTE: It will be necessary to have a helper alternately apply and release the service brakes when installing the drive axle to output shaft screws.

9. Install right hand output shaft to final drive, using extreme care when indexing splines of output shaft with splines on final drive.

CAUTION: Extreme care must be used when installing output shafts to protect seal surface on shaft from nicks and scratches.

10. Install two bolts and washers securing right hand output shaft support to engine. Tighten bolts to 50 foot-pounds.

NOTE: Washers must be seated in grooves in support to assure proper alignment of the output shaft.

11. Rotate right hand drive axle toward front of car and align with output shaft.

12. Install six drive axle to output shaft screws and tighten to 65 foot-pounds.

NOTE: It will be necessary to have a helper alternately apply and release the service brakes when installing the drive axle to output shaft screws.

13. Remove short lengths of heater hose previously installed on lower control arm torsion bar connectors.

14. Install battery cable clip on output shaft support and secure with one bolt.

15. Install strut, final drive to right hand output shaft support and secure with two nuts, bolts and washers. Tighten bolts to 25 foot-pounds.

16. Tighten shock absorber lower mount nuts to 75 foot-pounds.

17. Install new gasket on final drive.

18. Position final drive cover to final drive and secure with eight screws. Tighten screws to 30 foot-pounds.

19. Install bolts "A" and "B" and nut "H" securing upper part of final drive case to transmission case. Tighten bolts and nut to 25 foot-pounds.

20. Reposition transmission oil cooler lines and connect to radiator and transmission.

21. Install transmission oil filler pipe, positioning clamp to final drive case and secure with one bolt.

NOTE: Install a new filler pipe O-ring.

22. Position transmission oil cooler lines clamp to engine and secure with one bolt.

23. Fill final drive unit.

24. Raise car, remove jack stands and lower car.

25. Connect negative battery cable.

26. Check engine oil level, start engine and check transmission fluid level. Add fluid as required.

27. Check output shaft seals, final drive to transmission connection and final drive cover for oil leaks.

43. Pinion Bearing Oil Seal Replacement

a. Removal

1. Remove final drive unit from car as described in Note 42a.

2. Working on bench, remove six pinion bearing housing to final drive case bolts.

3. Remove pinion bearing housing by applying a steady pull on the splined end of the pinion gear with one hand and gently rotating the pinion bearing housing with the other hand.

4. Remove pinion bearing housing O-ring and discard.

5. Inspect vent pin O-ring seal and replace if necessary.

6. Drive pinion gear oil seals from pinion bearing housing with a screw driver.

CAUTION: Use extreme care to prevent damage to pinion bearing housing oil seal surface.

b. Installation

1. Place pinion gear oil seals back to back with spring on seals exposed.

2. Install oil seals on Seal Installer, J-22212.

3. Drive on Seal Installer, J-22212, until tool bottoms against housing.

4. Install a new pinion bearing O-ring in final drive case.

5. Install pinion gear in final drive case.

6. Install Seal Protector, J-22236, over splined end of pinion gear.

7. Install pinion bearing housing over pinion gear. Gently rotate pinion bearing housing until properly seated in final drive case.

8. Install six pinion bearing housing to final drive case bolts. Tighten bolts to 35 foot-pounds.

9. Remove Seal Protector, J-22236.

10. Install final drive unit in car as described in Note 42b.

TORQUE SPECIFICATIONS (693 Only)

Material No.	Application	Size	Foot-Pounds
286-M	Drive Axle Nut	1-20	105
SAE 1020-1022	Stabilizer Link Bolt	5/16-18	14
GM 6010-M	Stabilizer Bracket to Frame.	5/16-18	14
280-M	Torsion Bar Crossmember Bolt . . .	7/16-14	40
301-M	Shock Absorber (upper)	9/16-12	75
301-M	Shock Absorber (lower)	9/16-12	75
300-M	Lower Control Arm Bushing Bolts . .	1/2-13	75
300-M	Upper Control Arm Bushing Bolts . .	1/2-20	75
301-M	Ball Joint Nut.	9/16-18	40
286-M	Tie-Rod to Knuckle	1/2-20	45
300-M	Inner Constant Velocity Joint to Output Shaft.	3/8-24	65
275-M	Output Shaft Support to Engine Block. .	7/16-14	50
280-M	Output Shaft Support to Brace	3/8-16	15
280-M	Output Shaft Support Strut to Final Drive	3/8-16	25
300-M	Left Hand Output Shaft Retainer Bolt . .	3/8-24	45

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings, and steel classifications.

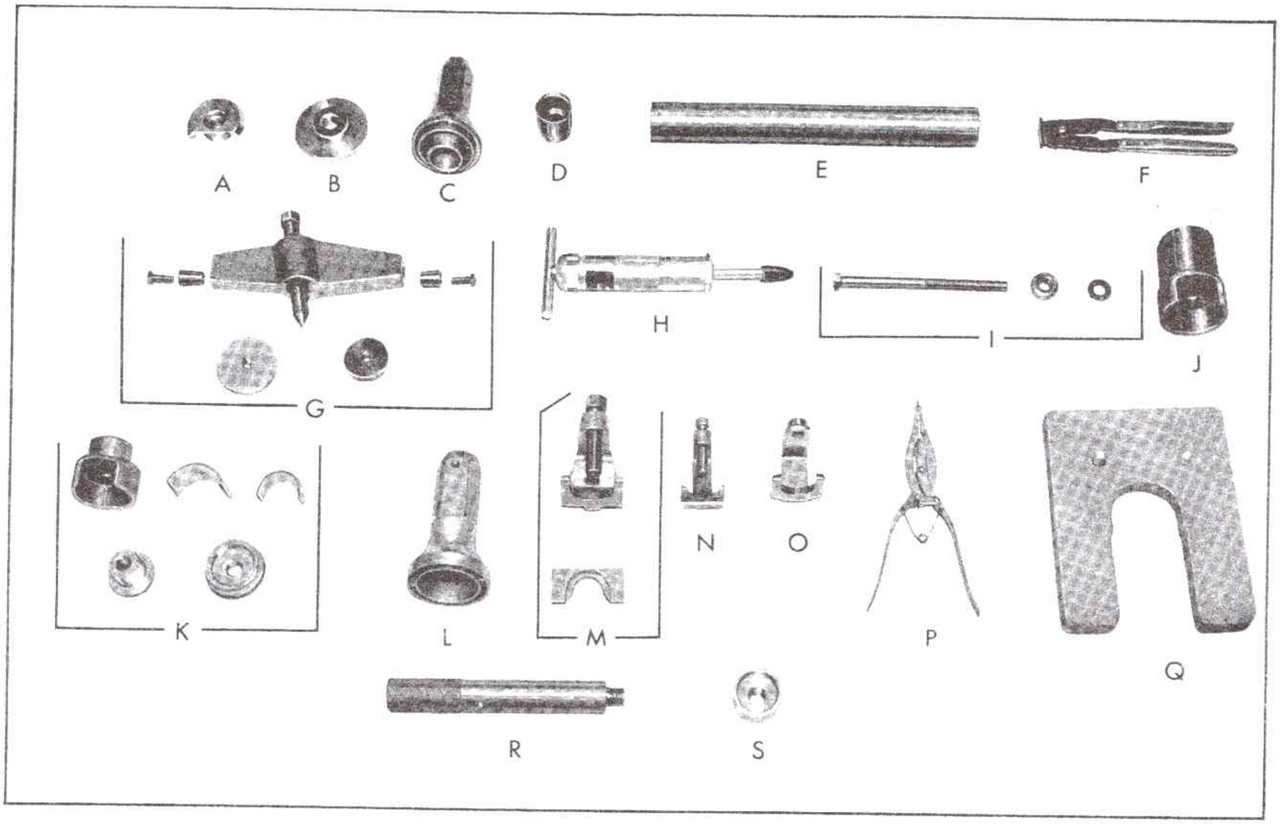


Fig. 3-65 Special Tools (693 Only)

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22198	Right Hand Output Shaft Seal Installer	J	J-21474-5	Bushing Remover and Installer
B	J-22199	Left Hand Output Shaft Seal Installer	K	J-22222	Bushing Remover and Installer Set
C	J-22212	Pinion Oil Seal Installer	L	J-22234	Front Knuckle Seal Installer
D	J-22236	Pinion Oil Seal Protector			
E	J-22609	Output Shaft Bearing Installer	M	J-22292	Linkage Puller
			N	J-21930	Tie Rod End Puller
F	J-22610	Band Installer	O	J-9231	Camber Adjusting Wrench
G	J-22214	Knuckle and Bearing Remover	P	J-8059	Snap Ring Pliers
H	J-9280-5	Lubrication Gun and Adapter Tip	Q	J-2986	Arbor Press Plate
			R	J-8092	Universal Handle
I	J-21474-3	Screw Assembly	S	J-8999-16	Bushing Installer

TABLE OF CONTENTS

GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado, refer to the latter portion of the appropriate subsection.

A trailing arm rear suspension system, consisting of two upper and two lower control links, steel coil springs, and shock absorbers, Fig. 4-1, is used on all conventional drive 1967 cars except the Commercial Chassis. The heavier Commercial Chassis used semi-elliptical multiple leaf rear springs.

On cars except the Commercial Chassis, the rear steel coil springs are placed on brackets on the rear axle housing at the lower ends, and the upper ends are seated in the frame crossmember, Fig. 4-1. With this design there are no spring loads acting directly on the suspension bushings, thereby providing good bushing isolation qualities. Spring insulators are used at both ends of the rear chassis springs to provide noise isolation.

Two upper control links are attached at their rear ends to inboard brackets on the rear axle housing and at their front ends to brackets just forward of the rear suspension cross member on the frame side rails. Two lower control links are attached at their rear ends to outboard brackets on the rear axle housing and on their front end to brackets on the frame side rails. The angles of the upper control links from the center of the axle outward, and of the lower control links from the ends of the axle inward provide good lateral stability.

Oversize bushings are provided at all eight suspension attaching points to give maximum noise isolation. The upper and lower link bushings are the same size but are not interchangeable in application as different rubber specifications are required for these two locations.

The rear shock absorbers are mounted at their upper ends in frame brackets to the rear of the axle center line. The lower ends are attached to the lower control link mounting brackets on the axle housing.

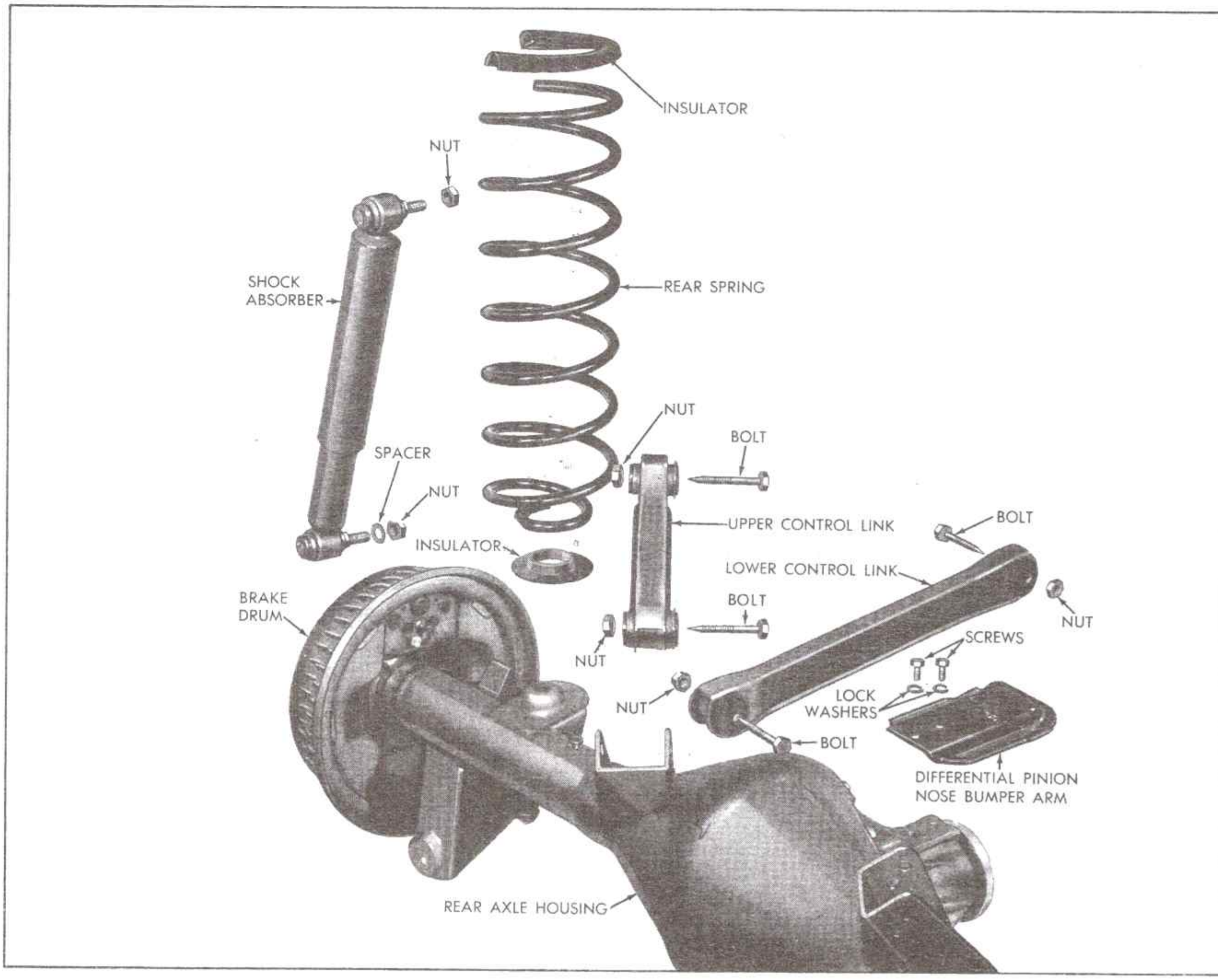


Fig. 4-1 Rear Suspension Disassembled

The same type of shock absorbers are used on all cars except cars equipped with Automatic Level Control. In this case, Superlift shock absorbers are used on the rear suspension system. Individual valving is provided for the Commercial Chassis.

Rear Suspension System (Commercial Chassis Only)

The rear springs are of the semi-elliptical multiple leaf type. They have nine leaves, 2-1/2 inches wide with full length polyethylene liners between the first four leaves to provide correct interleaf friction and prevent squeaks. The spring eyes are cushioned at each end by rubber bushings and at the spring seats on the axle housing by rubber insulating pads.

Direct acting type rear shock absorbers are connected at the bottom to the rear spring U-bolt plates and at the top to brackets welded to the rear suspension frame cross member. This type rear shock absorber mounting provides minimum transverse roll along with dampening of road shocks.

Automatic Level Control

a. System (Fig. 4-2)

Automatic pneumatic leveling is provided as standard equipment on the Fleetwood Sixty Special Sedan and Brougham, and the Fleetwood Seventy-Five sedan and limousine, and optional on all other models. The system consists of an air compressor and tank assembly, pressure regulator, control valve and link, two Superlift rear shock absorbers and flexible air lines.

As load is added, the Superlifts inflate and extend, raising the car to its initial level. As load is removed Superlifts deflate and retract, lowering the car to its initial level. After completion of work on this system, or when servicing other parts of the car and the system is deflated, inflate the reservoir to 140 psi or maximum pressure available, by applying dry air through the compressor service valve.

b. Compressor and Reservoir

The compressor operates on the difference between (1) engine manifold vacuum, supplied to the compressor by an air line connected to the crankcase ventilator valve vacuum line connection, and (2) a higher pressure air at or near atmospheric pressure, available through an air supply line at the air cleaner.

The compressor supplies high pressure air to the reservoir. The compressor is a two-stage type, requiring no lubrication. It is designed to operate intermittently to replenish air used from the reservoir. As the compressor cycles, the reservoir air pressure gradually increases, causing a back pressure on the second stage piston until it equals the push of atmospheric pressure against the diaphragm. At this point, a balanced condition is reached and the unit stops operating. After reservoir pressure drops due to system air usage, the compressor again begins to cycle and replenish the reservoir.

Balance pressure will depend upon the prevailing manifold vacuum at the carburetor insulator and prevailing atmospheric pressure. Both are affected by altitude above or below sea level. Balance pressure will vary from approximately 150 psi to 275 psi.

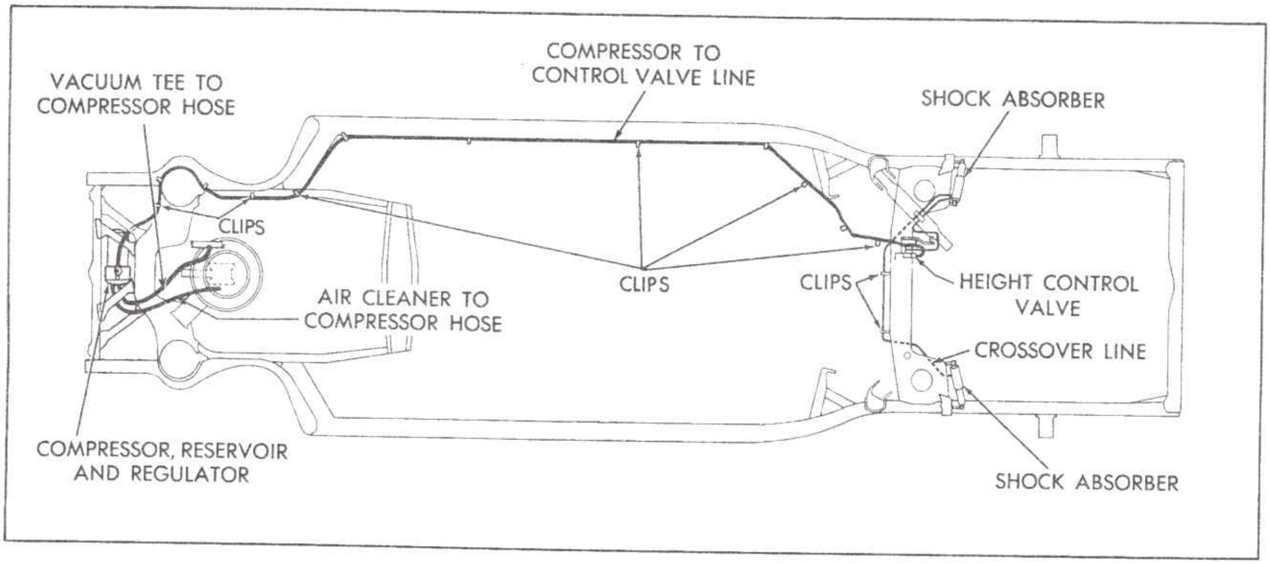


Fig. 4-2 Automatic Level Control

c. Pressure Regulator

A pressure regulator is attached to the output side of the reservoir. It regulates Superlift supply pressure to approximately 125 psi.

d. Control Valve and Link

The rear standing height is automatically maintained at a nearly constant position by a control valve attached to the rear suspension cross member. A link attaches the valve lever to the right-hand upper control link. When sufficient load is added to deflect the rear suspension at least 1/2 inch, the control valve admits air to the Superlifts, which then raise the car to level. When load is removed, and the car rises, the control valve exhausts air from the Superlifts, which lower the car to level. A four to eighteen second time delay mechanism inside the control valve housing prevents transfer of air when the lever is moved during normal ride motions. In this manner the control valve responds only to actual load changes of sufficient duration to overcome the delay action.

e. Superlift Rear Shock Absorber (Fig. 4-3)

The Superlift is essentially a conventional shock absorber enclosed in an air chamber. A pliable nylon reinforced neoprene boot seals the dust tube (air dome) to the reservoir tube (air piston). The unit will extend when inflated and retract when deflated by the control valve. One unit is connected to the control valve by a flexible air line. This unit has a second port which is connected by another flexible line to the single port unit on the other side of the car. The crossover line equalizes air pressure in the two Superlifts.

An eight to fifteen psi air pressure is maintained in the Superlift at all times to minimize boot friction. This is provided by a check valve in the exhaust fitting on the control valve.

f. Lines and Fittings

Flexible air lines of 1/8 inch diameter tubing are used throughout the system. Each fitting consists of a rubber seal, metal sleeve and nut. These parts are designed specifically for the 1/8 inch diameter line and must be used to effect a reliable seal.

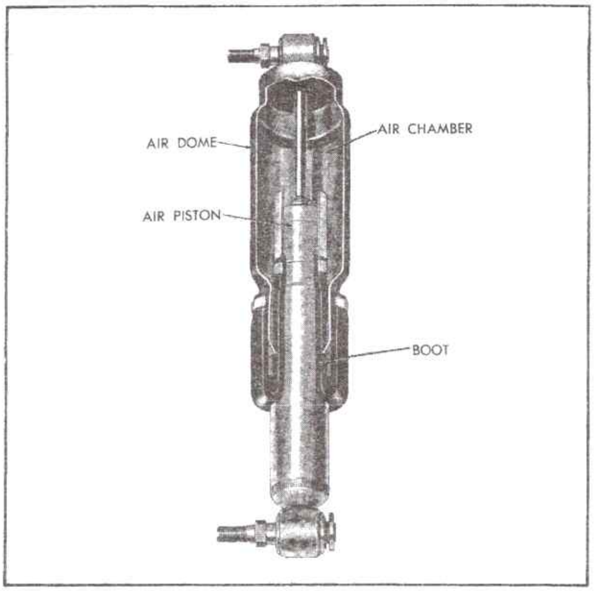


Fig. 4-3 Superlift Shock Absorber

While the lines are flexible for easy routing and handling, care should be taken not to kink them and to keep them from coming in contact with the exhaust system.

g. Dealer Installation

As a dealer-installed option, the Automatic Level Control system may be installed either by retaining standard suspension springs or by changing to the option spring, as the customer desires.

The standard spring will provide approximately 150 lbs. additional load carrying capacity, but will have a firmer ride and will trim at the same height as cars without the level system.

The special Automatic Level Control spring installed at the factory, and available in service, provides a softer ride and lower rear trim height while maintaining the level conditions for average passenger and trunk loads.

SERVICE INFORMATION

NOTE: For service information pertaining to the Fleetwood Eldorado refer to the latter portion of the appropriate subsection.

1. Checking Rear Standing Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack, and that there is a full tank of gasoline, as all specifications are based on this curb weight. If car is equipped with Automatic Level Control, deflate system using service valve, then disconnect air line from superlift port on control valve. Normalize position of springs by bouncing bumper up and down; release bumper and permit car to assume its normal position.

a. Rear Springs

Measure distance from top of rear axle housing

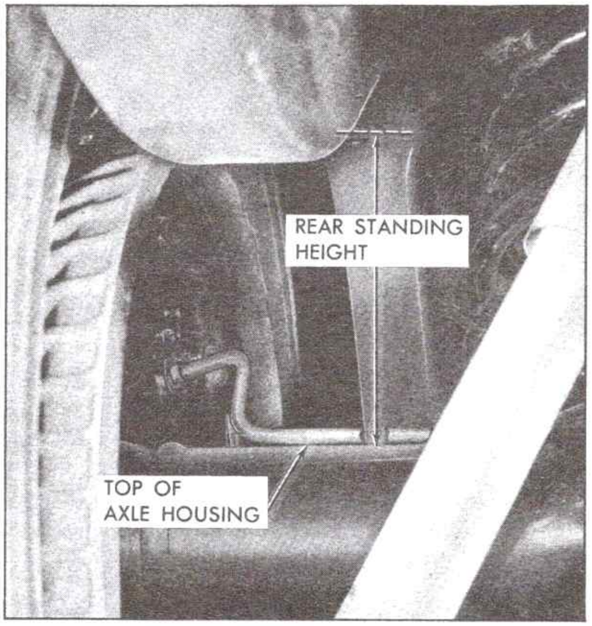


Fig. 4-4 Measuring Rear Standing Height

straight up to lower underside surface of frame, Fig. 4-4. Rear standing heights should be equal within 1/2 inch on both sides of car. If heights are unequal, spring that checks below specifications must be replaced.

b. Ride Complaints

In case of hard riding, the first items to investigate are correct tire pressure, correct standing heights, and correct shock absorbers for the car. If these are correct, the amount of friction in the rear suspension system should be checked.

The procedure for checking excessive friction in the rear suspension is as follows:

1. Disconnect rear shock absorbers.

2. With aid of a helper, lift up on the rear bumper and raise the end of the car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height. Measure distance from floor to center of bumper.

3. The difference between the two measurements should be less than 1/2 inch. If the difference exceeds the limit, inspect the upper and lower control links for damaged or worn parts.

2. Rear Shock Absorbers

a. Removal

1. Raise rear end of car and place jack stands under axle housing.

CAUTION: The shock absorbers act as rebound stops for the rear suspension. Under no circumstances should rear end of car ever be raised so that rear suspension is in rebound position while disconnecting shock absorber.

2. If car is equipped with Automatic Level Control, remove two air line fittings at right shock absorber and one air line fitting at left shock absorber.

3. Remove shock absorber upper retaining nut. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent it from turning, while removing retaining nut with a second wrench. Remove shock absorber lower retaining nut and spacer, holding stem in same manner.

NOTE: Be careful not to damage brake piping on axle housing throughout procedure.

4. Remove shock absorber from its mounts.

b. Installation

1. Guide upper and lower shock absorber stems into mounts.

2. Install upper retaining nut. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent it from turning while installing retaining nut with a second wrench.

3. Install shock absorber lower spacer and retaining nut, holding stem in same manner.

4. If car is equipped with Automatic Level Control, install two air line fittings at right shock absorber or one air line fitting at left shock absorber, tightening tube nuts to 30-40 inch pounds. Inflate reservoir through service valve to 140 psi or maximum pressure available using dry air.

3. Checking Rear Shock Absorbers

a. On Car Checks

1. Raise car on hoist.

2. Check for correct mounting of shock absorbers. If properly mounted, continue with next step.

3. Disconnect lower shock mount. Extend shock absorber and check to see if piston rod and seal

(top of shock) cover is wet with a fresh film of oil. If oil is detected on rear shock absorber, remove the unit for bench check.

NOTE: This check cannot be made on Superlift shock absorbers.

4. If no oil is detected, pump shock absorber up and down by hand as fast as possible. If a skip is felt at end of stroke, remove absorber for bench check.

5. As another check, completely extend shock absorber and pull hard. If spring tension is felt, shock absorber should be replaced.

IMPORTANT: Pumping shock absorber by hand will not fully determine whether a shock absorber is good or bad. The best test method is to compare the questionable shock absorber with its mate on opposite side of car; that is, a front with the other front, and rear with the other rear. If both shocks feel the same, it is unlikely that a shock absorber replacement is necessary. Bad shocks as detected by this test, will affect ride motion only.

b. On Bench Checks (Standard Shock Absorbers)

1. When performing a bench check for any suspected shock absorber, clamp shock absorber upside down in a vise.

NOTE: Cadillac standard shock absorbers can be turned upside down because all internal vapor (inert gas instead of air) is contained in a pliacell envelope which prevents aeration of oil and prevents lag.

2. Pump shock absorber by hand at various rates of speed to find if shock absorber is defective. If a skip is felt at full extension when the shock is inverted, this is normal. A skip on reversal of direction in mid-travel indicates a ruptured pliacell envelope. If smooth resistance is felt throughout length of the stroke, however, the shock absorber need not be replaced. A faint hiss ("orifice swish") is considered normal, but a gurgling noise denotes air bubbles in the fluid, and the shock absorber should be replaced.

c. On Bench Checks (Superlift Shock Absorbers)

1. Clamp lower mounting ring in vise in vertical position with air dome up.

2. Extend and collapse shock completely several times to discharge air out of the working chamber.

3. Pump unit by hand at different rates of speed. Smooth resistance should be felt throughout the length of the stroke. Since the Superlift is normally pressurized, the sound of air bubbles or a gurgling noise is not abnormal.

4. Rear Spring

a. Removal

1. Raise rear end of car. Place hydraulic jack under differential and jack stands under frame side rails, and remove wheel from side of car where spring is to be removed.

2. If car is equipped with Automatic Level Control, disconnect link at overtravel lever by removing nut and lockwasher. Position overtravel lever in center position.

3. Remove shock absorber lower retaining nut and washer and stem from mount on side where spring is to be removed. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent the stem from turning, while removing retaining nut with a second wrench.

NOTE: Be careful not to damage brake piping on axle housing, now, and throughout procedure.

4. Remove rear bolt from upper control link on side of car where spring is to be removed. Free rear upper control link from mounting.

NOTE: It may be necessary to place a second jack by the differential carrier nose to facilitate removal of bolt.

5. If removing right rear spring, disconnect brake line hose at bracket on rear suspension cross member. Remove clip that retains hose to bracket and separate hose from bracket. Also remove one screw that secures parking brake cable strap.

6. Remove jack at differential carrier pinion nose and slowly lower second jack from differential.

7. Place jack under side of rear lower control link mount opposite that of the spring being removed.

8. Raise jack until spring can be removed from mount. Inspect lower and upper rubber insulators. Replace if necessary.

b. Installation

1. Make certain frame side rails are supported on jack stands and side opposite spring being installed is in compression position.

2. Position lower rubber insulator on rear axle housing mount.

3. Tape upper rubber insulator to top of spring and position spring so that end of top of spring is properly aligned with recess in upper seat of frame tower.

4. Seat bottom of spring on lower rubber insulator.

5. Lower jack and place under differential housing. Raise jack and check spring position.

6. Install lower shock absorber stem in mount and secure with washer and retaining nut.

7. Position jack under differential carrier to take up load. Use a second jack under differential carrier pinion nose to permit positioning of upper control link in its mount. Install bolt and start the nut.

8. If right rear spring was installed, connect brake line hose loosely at bracket on rear suspension cross member. Install clip that secures hose to bracket and tighten fitting. Bleed brakes as described in Section 5, Note 9. Also install screw securing parking brake cable clamp.

9. Remove jack stands and lower car. The car is now at standing height.

10. Tighten upper control link bolt to 90 foot-pounds.

> NOTE: Pivot bolt in control link must be torqued at standing height. If it is not, the ride rate will be affected.

11. If car is equipped with Automatic Level Control, secure link to overtravel lever with attaching nut and lockwasher. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

5. Rear Lower Control Link

a. Removal (Fig. 4-5)

1. Raise rear end of car and place on jack stands.

2. If car is equipped with Automatic Level Control, disconnect link at overtravel lever by removing nut and lockwasher. Position overtravel lever in center position.

3. Remove front and rear lower control link nuts.

> NOTE: Be careful not to damage brake piping on axle housing, now, and throughout procedure.

4. Place jack under front of differential to relieve tension on lower link bolts.

5. Remove front and rear lower control link bolts and link.

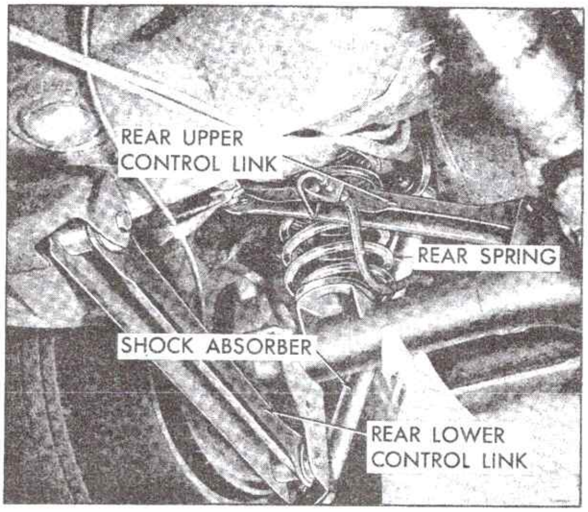


Fig. 4-5 Rear Suspension

> NOTE: The front and rear bushings in the lower control links are not serviceable. These bushings are the same size as the upper control link bushings but are not interchangeable as the rubber has different characteristics. The wrong bushing may cause poor handling or increased axle noise.

b. Installation

1. Slide lower control link into position with the flange of the bushing inboard, and install two screws from inboard side. Adjust jack under front of differential as necessary to install screws.

2. Loosely install nuts on screws.

3. Remove jack stands and lower car. The car is now at standing height.

4. With car at standing height, tighten front and rear lower control link bolts to 90 foot-pounds.

> NOTE: Pivot bolts in control links must always be torqued at standing height. If they are not, the ride rate will be affected.

5. If car is equipped with Automatic Level Control, secure link to overtravel lever with attaching nut and lockwasher. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

6. Rear Upper Control Link

a. Removal

1. Raise rear end of car, and place on jack stands.

2. If car is equipped with Automatic Level Control, remove attaching nut that secures link to right hand upper control link, Fig. 4-14. Position overtravel lever in center position.

3. Working at front of link to be removed, mark floor pan with a punch, in line with center of bolt head.

NOTE: Be careful not to damage brake piping on axle housing, now, and throughout procedure.

4. Remove rear cushion and seat back.

5. Drill 1-1/4 inch hole in floor pan using mark on floor pan as center of hole.

NOTE: Use only 1-1/4 inch drill as plug used during assembly is designed to fit this size.

6. Place jack under differential housing and raise jack to relieve tension on upper control link.

7. Remove rear pivot bolt.

8. Remove forward pivot bolt, and guide the screw through hole in floor pan. Remove upper control link.

NOTE: The front and rear bushings in the upper control links are serviceable and can be removed and installed by using an arbor press. These bushings are the same size as the lower control link bushings but are not interchangeable as they have different rubber characteristics. The arm and bushings are replaced as a complete assembly.

b. Installation

1. Install arm with flanged surfaces at bushing inboard.

2. Loosely install front pivot bolt after first guiding the screw through floor pan.

3. Loosely install rear pivot bolt in upper hole of bracket. Adjust jack under front of differential as necessary to install bolts.

NOTE: The lower hole in axle housing mounting bracket is a manufacturing hole, and must not be used.

4. Remove jack stands and lower car. The car is now at standing height.

5. Tighten front and rear pivot bolts to 90 foot-pounds.

NOTE: Pivot bolts in control links should be torqued only at standing height. If they are not, the ride rate will be affected.

6. Install a 1964 windshield wiper mechanism access hole plug in floor pan.

7. Replace seat back and cushion.

8. If car is equipped with Automatic Level Control, secure link to right hand upper control link with attaching nut. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

7. Rear Leaf Spring Liner Service (Commercial Chassis)

Replacement rear spring liner tips are available for installation between the spring leaves when original liners wear at the outer ends.

To install these replacement liner tips, it is necessary to use a hardwood wedge 2-1/2 inches wide, 5 inches long, and tapered from 1/8 inch to 3/4 inch thick in 2 inches of length. Proceed as follows:

1. Remove spring rebound clips.

2. Raise rear of car until springs are in full rebound position.

3. Mark off length of replacement liner tip on main spring leaf, allowing 1/2 inch projection beyond second leaf.

4. After placing a piece of sheet metal between liner and spring leaf to protect leaf, pry first and second leaves apart and insert wedge under liner just beyond point where old liner is to be cut off.

NOTE: It is necessary to protect the spring leaf because a small nick in the leaf from a steel wedge could cause a point of fatigue that may result in spring failure. Use a hardwood wedge whenever possible.

5. Cut off worn end of original liner with a hacksaw blade. Grinding off a 4 inch section of the back of the saw blade to 1/4 inch width will permit sawing liner without spreading spring leaves too far apart.

6. Install new liner tip with button end toward axle. Work out wedge, keeping liner tip in position.

7. Repeat above operation at each of the two upper liners in each rear spring.

8. Rear Leaf Spring (Commercial Chassis)

a. Removal

1. Jack up car so that weight of body is entirely off the spring and support axle housing with adjustable stands.

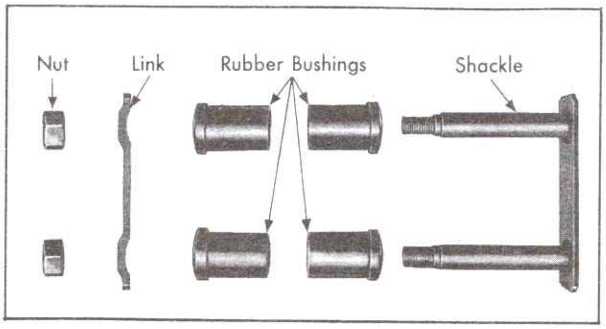


Fig. 4-6 Rear Leaf Spring Shackle

2. Remove front shackle bolt nut and drive out shackle bolt.

3. Disconnect shock absorber from U-bolt plate.

4. Remove rear shackle nuts and link, Fig. 4-6.

5. Remove U-bolt nuts, washers, lower spring plate, lower insulator retainer and insulator pad.

6. Remove spring from rear shackle by removing shackle from frame or by driving spring off shackle.

b. Installation

1. Install new bushings in spring eyes and in shackle-to-frame mounting sleeves.

2. Install shackle on frame.

3. Install spring on lower shackle bolt.

4. Line up front spring eye on bracket on frame and install bolt from inner side of frame. Install nut, but do not tighten until car is lowered.

5. Install shackle link and shackle nuts.

6. Install insulator pad and retainer on top of spring, with hole in pad and retainer over spring center bolt.

7. Position center of spring under rear axle housing bracket with spring center bolt located in hole provided in bracket.

8. Install insulator pad, retainer, and U-bolts; and install U-bolt nuts and lockwasher, torquing to 45 foot-pounds.

> NOTE: Lower car before tightening U-bolts or rear shackle nuts. This permits rubber bushings to take a neutral position and assures a more accurate torquing.

9. Connect rear shock absorber at spring U-bolt plate.

10. Tighten front eye bolt and rear shackle nuts to 70 foot-pounds.

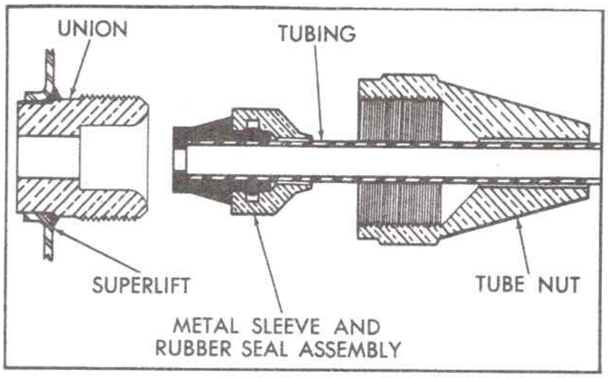


Fig. 4-7 Typical Tubing Fitting

9. Tubing

> NOTE: Tubing may be removed by simply unscrewing nut. Be sure system is deflated when separating air lines. When installing tubing at any Automatic Level Control fitting, be careful not to kink line.

1. Preassemble metal sleeve and rubber seal, Fig. 4-7.

2. Place nut on tubing.

3. Insert tube into metal sleeve and rubber seal until tube bottoms.

4. Holding tubing in bottomed position, tighten tube nut securely (30-40 inch pounds).

> NOTE: Tubing may be reinstalled at its connections. If tubing is cracked at end, it will be necessary to cut flush and use a new metal sleeve and rubber seal to assemble connector. Be careful not to remove too much, or tubing may be kinked or broken at full suspension travel. Care should be taken that proper routing is followed in areas close to the exhaust system to prevent burning the tubing. Note particularly the areas at rear suspension cross member.

10. System Test

The source of a system problem is best pinpointed by checking the air supply and control sections separately.

1. Perform the Compressor Output Test On Car, as described in Note 11.

2. If satisfactory, proceed to Control Valve Test and Fluid Replacement as described in Note 18.

11. Compressor Output Test-On Car

1. With Climate Control off and transmission selector lever in Neutral, run engine until fast idle screw is off fast idle cam. Turn off ignition.

2. Deflate system through service valve and remove high pressure line at regulator adapter fitting and connect Test Gage, J-22124, Fig. 4-8.

3. Inflate reservoir to 70 psi through service valve.

4. Observe Test Gage for evidence of compressor air leak.

5. If compressor is leaking, proceed to leak test compressor reservoir and regulator as described in Note 20a. If not leaking, continue this test.

6. With engine running at slow idle, observe reservoir build-up for five minutes. Reservoir pressure should build-up to a minimum of 90 psi.

7. If compressor fails to cycle, make sure the vacuum and air intake lines are not reversed and are open and unobstructed before removing compressor for repair.

8. If build-up is too slow, proceed to repair compressor as outlined in Notes 13 to 15.

9. Satisfactory build-up indicates system problem to be in the control section, Note 18. However, again observe the Test Gage for evidence of an air leak and proceed accordingly.

12. Compressor, Reservoir and Regulator Assembly

a. Removal

1. Raise front of car on hoist or jack stands.

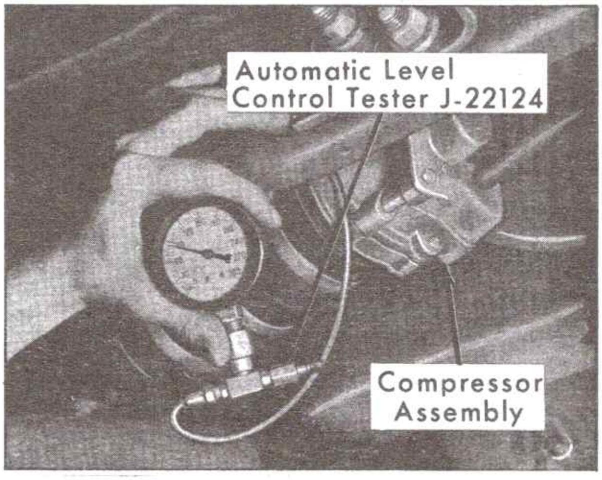


Fig. 4-8 Testing Compressor Output

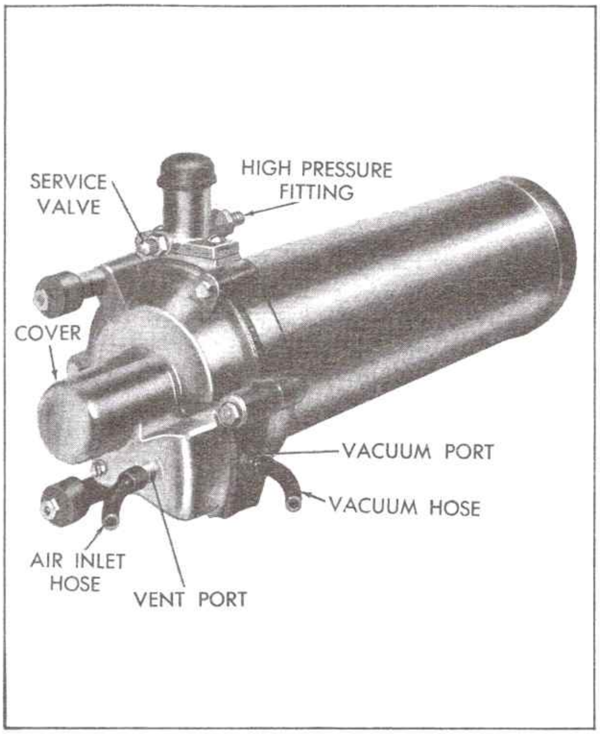


Fig. 4-9 Compressor Hose Connections

2. For identification purpose, place a piece of tape on the air intake line attached to the end (smooth) fitting on the compressor, Fig. 4-9.

3. Remove the air intake and vacuum hoses.

4. Remove two self-tapping screws securing the compressor brackets to the left upper and right lower front cross member reinforcements.

5. Remove compressor from frame with brackets attached.

6. Deflate system by using the service valve, and remove high pressure fitting at compressor pressure regulator.

7. Remove upper bracket from compressor by removing two nuts and lockwashers. Remove lower bracket from compressor by removing one nut and lockwasher.

b. Installation

1. Attach upper bracket to compressor with two nuts and lockwashers. Attach lower bracket to compressor with one nut and lockwasher.

2. Install compressor to left upper and right lower front cross member reinforcements with two self-tapping screws.

3. Attach air intake and vacuum hoses.

4. Secure air line at compressor pressure regulator by following procedure outlined in Note 9.

5. Remove jack stands and lower car.

6. Inflate reservoir to 140 psi through compressor service valve.

CAUTION: Position vacuum and air intake lines away from power steering pump pulley and belts to prevent chafing.

13. Disassembling Compressor, Reservoir and Regulator into Major Components (Fig. 4-10)

The compressor is a precision-built mechanism. All parts should be carefully handled and assembled. Take care to prevent entrance of dirt or foreign matter. DO NOT LUBRICATE as unit is designed to run dry.

1. Remove compressor as described in Note 12a or 25a.

2. Remove three flexible mounts and three adapters.

3. Remove reservoir retaining through bolt, cover retaining screw and cover gasket that secure cover and gasket to first stage housing. Remove cover and discard gasket.

4. Remove two regulator retaining screws, regulator assembly and O-ring from second stage housing. Discard O-ring.

5. Remove three nuts at reservoir flange and two through bolts that enter from flanged side of reservoir. Separate reservoir and O-ring. Discard O-ring.

6. Remove three compressor retaining through bolts that secure second stage housing to first stage housing.

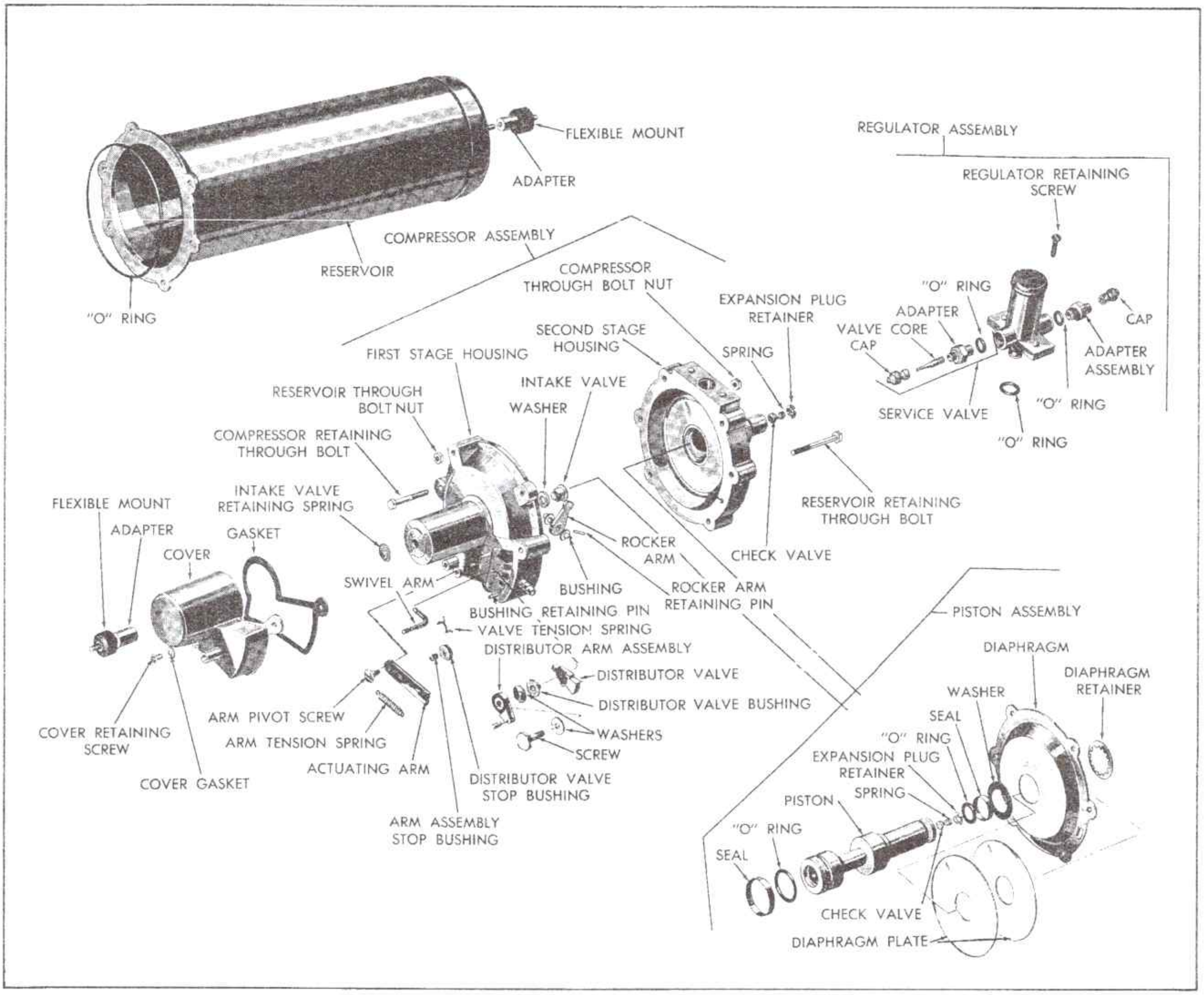


Fig. 4-10 Compressor Assembly Disassembled

7. Slide second stage (small diameter) housing straight off piston.

8. Disconnect arm tension spring from swivel arm.

9. Remove arm pivot screw and actuating arm.

10. Slide piston assembly straight out of first stage housing.

14. Compressor, Reservoir and Regulator Disassembly, Inspection and Assembly of Major Components

a. Diaphragm

Inspection

1. Inspect diaphragm for holes, looseness or other defects and replace if necessary.

Disassembly

1. Remove diaphragm retainer with diagonal pliers and discard.

2. Remove diaphragm plate, diaphragm, second diaphragm plate and washer from piston.

Assembly

1. Install new washer, old plate, new diaphragm with outer lip toward second stage side, Fig. 4-10, and second plate. Plates should be installed so that lip on both plates faces outboard from diaphragm.

2. Use a 13/16 inch deep socket as a pilot for the new diaphragm retainer. Press against the piston shoulder on first stage side, Fig. 4-11, to position diaphragm retainer. The wood blocks used are each 3/4 inch x 3/4 inch x 12 inch.

NOTE: Position diaphragm retainer securely to effect air tight seal against washer.

b. Seals

Inspection

1. Inspect seals for evidence of excessive wear or scoring. If necessary, replace seals and O-rings.

Removal

1. Remove seals and O-rings from piston.

Installation

1. Install new O-rings by rolling into groove. Relieve any resulting twist.

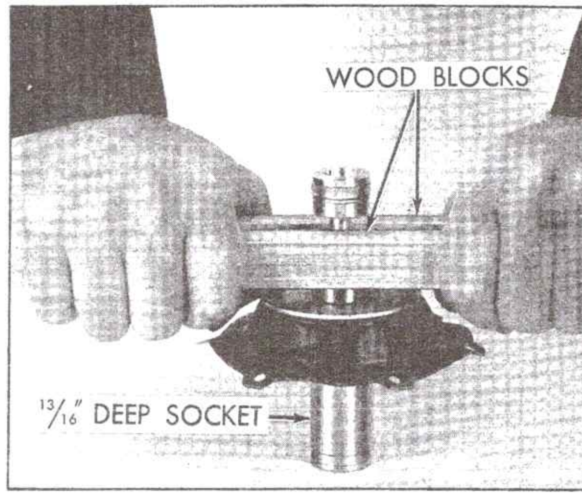


Fig. 4-11 Installing Diaphragm Retainer

2. Install new seals using a piece of .020" shim stock, Fig. 4-12. Make sure shim stock has no sharp edges that may cut seal. Do not stretch seal more than necessary to install. Seals should be installed so they are not twisted.

c. Distributor Valve Mechanism and Intake Valve (First Stage Housing)

NOTE: Actuate distributor valve with finger. Valve tension spring should press against distributor valve, holding it against either stop. If valve action is not free and positive, it will be necessary to rebuild, using new parts in Distributor Valve and Arm Package. If action is free and positive, and inspection upon disassembly shows no damaged parts, parts may be re-used.

Disassembly

1. Remove screw, washer, distributor arm assembly, washer, and distributor valve bushing.

2. Remove two arm assembly stop bushings and two distributor valve stop bushings.

3. Remove distributor valve being careful not to distort valve tension spring.

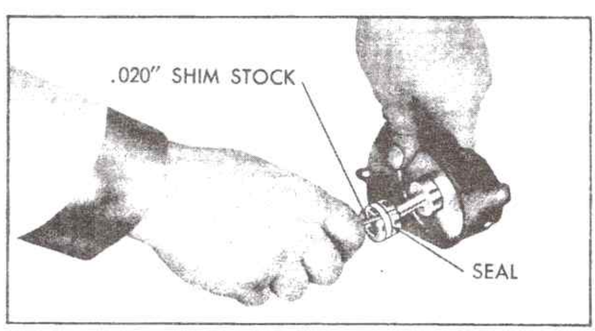


Fig. 4-12 Installing Seal

4. Remove valve tension spring from bowl cover boss, again being careful not to distort valve tension spring.

5. Remove intake valve retaining spring, intake valve and washer using pocket knife.

6. If necessary, remove rocker and swivel arms. Position pin for removal by prying with screwdriver, Fig. 4-13. Grip pin with water pump pliers and remove pin. Remove swivel arm, rocker arm and bushings.

Cleaning and Inspection

1. Clean all parts in clean solvent except distributor arm assembly and blow dry with compressed air.

2. Inspect distributor valve for cracks. Discard if damaged.

3. Inspect all other parts for wear or damage.

Assembly

1. If removed, position bushings in first stage housing and install rocker arm and swivel arm. Align hole in rocker arm with swivel arm and install rocker arm retaining pin, small end first.

NOTE: If distributor mechanism failed to function properly or one or more parts were found defective, use new parts in distributor valve and arm package during remaining build-up.

2. Install washer on intake valve and install in first stage housing with intake valve retaining spring.

3. Install longer leg of valve tension spring into boss on first stage housing, being careful not to distort valve tension spring.

4. Position distributor valve, being careful not to distort valve tension spring.

5. Install two distributor valve stop bushings and two arm assembly stop bushings.

6. Install distributor valve bushing, washer, distributor arm assembly, and washer and secure with screw. Tighten to 12 inch pounds.

NOTE: Do not install remaining parts at this time as rocker arm must be free to permit entrance of piston into first stage housing.

d. Check Valve Replacement (Second Stage Piston)

1. Pry out expansion plug retainer on second stage piston with pointed tool and remove spring and check valve.

2. Pour a small amount of clean solvent through

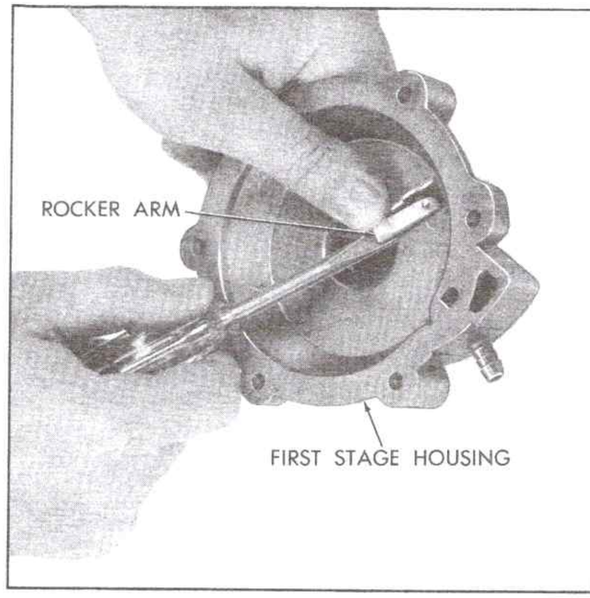


Fig. 4-13 Removing Rocker Arm

bore in piston and blow dry with compressed air. Check valve seat should be smooth and clean.

3. Install new check valve and spring.

4. Insert new expansion plug retainer and tap in until it bottoms.

e. Check Valve Replacement (Second Stage Housing)

1. Pry out expansion plug retainer on second stage housing with pointed tool and remove spring and check valve.

2. Clean second stage housing with clean solvent and blow dry with compressed air. Check valve seat should be smooth and clean.

3. Install new check valve and spring.

4. Insert new expansion plug retainer and tap in until it bottoms.

15. Assembling Compressor Reservoir and Regulator from Major Components

1. Slide piston assembly straight into first stage (large diameter) housing.

2. Install actuating arm and attach to first stage housing with arm pivot screw.

3. Connect arm tension spring to swivel arm.

4. Rotate piston in first stage housing to align elongated hole in diaphragm with vent port in first stage housing.

5. Install three compressor retaining through bolts that secure second stage housing to first stage housing. Housings will align one way only. Nuts are positioned in counterbores in second stage housing. Tighten to 28 inch-pounds.

6. Install new O-ring on second stage housing. Wash inside of reservoir in clean solvent and blow dry with compressed air. Install reservoir on second stage housing with three nuts, tightening to 28 inch-pounds. Install two reservoir retaining through bolts, tightening to 28 inch-pounds. Through bolt heads should be positioned against reservoir. Do not install through bolt that secures cover at this time.

7. Install new O-ring on regulator and secure regulator with two regulator retaining screws. Tighten to 35 inch-pounds. Service valve should be on same side as second stage housing.

8. Install new gasket and cover, and secure with cover retaining screw and new cover gasket. Tighten cover retaining screw to 35 inch-pounds. Install through bolt with head positioned against reservoir. Tighten through bolt to 28 inch-pounds.

9. Install three adapters and flexible mounts.

10. Proceed to compressor output test on car, Note 11.

11. If compressor passes output test, install as outlined in Note 12b or 25 b.

16. Regulator Test and Adjustment

Performance test the regulator with a known good compressor on the car.

1. Deflate system through service valve, remove line at regulator and connect Test Gage J-22124 at regulator adapter.

2. Inflate reservoir through service valve to maximum pressure available. If less than 140 psi, start engine to build up reservoir to this pressure.

3. Regulated pressure on the Test Gage should build up to 100-130 psi and hold steady within this pressure.

4. Recheck regulated pressure by momentarily depressing valve core on Test Gage and observe gage reading.

5. If regulated pressure reads under 100 psi, remove boot and reposition the sleeve retainer deeper into the body, using a deep well socket.

6. If regulated pressure exceeds 130 psi, replace regulator as a unit.

17. Trim Adjustment—On Car

Trim adjustment should be performed with a full fuel tank (or the equivalent in load at the rate of 6 lbs/gallon).

a. Preparation

1. Raise car with rear axle supported.

2. Remove Superlift line at control valve, Fig. 4-14.

3. Connect a Fill Valve Assembly, J-21999 to this line (male end).

4. Inflate Superlifts to 8-15 psi. Jounce car to neutralize suspension.

5. Connect Test Gage J-22124 to Superlift adapter on control valve and attach air pressure source (80-110 psi).

b. Adjustment

1. Loosen overtravel lever adjusting nut.

2. Hold overtravel body down in exhaust position until air escapes from exhaust valve port.

3. Slowly move overtravel body and tighten nut at the point of minimum air bleed. With nut tight, a slight continuous air bleed should be noticeable.

c. Restore System

1. Remove Test Gage and air pressure source from Superlift adapter.

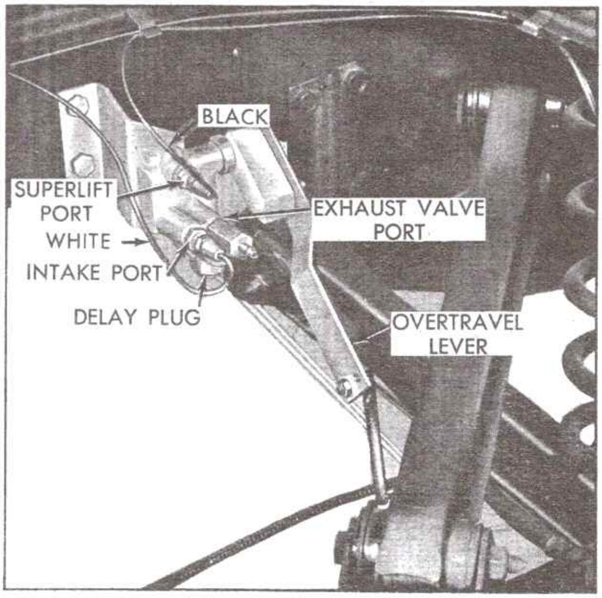


Fig. 4-14 Height Control Valve

2. Remove Fill Valve Assembly, J-21999, from Superlift line and reconnect line to control valve.

3. Lower car and inflate reservoir through service valve.

18. Control Valve Test and Fluid Replacement

NOTE: If tests are performed when car is cold, (15°F or less) time delay may be as much as 30 seconds.

a. Exhaust (Superlifts Inflated)

1. Disconnect overtravel lever from link.

2. Hold lever down in exhaust position until Superlifts deflate or for a minimum of 18 seconds.

3. If Superlifts deflate, perform Intake Check.

4. If Superlifts do not deflate, remove exhaust adapter from control valve and hold lever down as in step 2. Replace adapter, O-ring and filter if this deflates Superlifts.

5. Replace control valve if none of the above steps correct the condition.

b. Intake (Reservoir Pressure 125 psi Minimum)

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position until Superlifts inflate or for a minimum of 18 seconds.

3. If Superlifts inflate and hold, proceed to Time Delay Check.

4. If Superlifts inflate and then leak down, perform leak test on lines and fittings and then on Superlifts, Note 20.

5. If Superlifts do not inflate, check air source. Also check and, if necessary, replace intake and Superlift screens and O-rings. If Superlifts still do not inflate, perform leak test on valve, Note 20b. Repair as indicated and proceed to time-delay check.

c. Time Delay Check

1. Disconnect overtravel lever from link.

2. Disconnect lines at Superlift and intake ports.

3. Connect Test Gage, J-22124, to intake valve port and open air pressure (95 psi). Move overtravel lever approximately one inch down from neutral position as measured from end of lever, and hold for 15-20 seconds.

4. Quickly move overtravel lever upward two inches; at the same time begin timing number of seconds before air starts to escape from Superlift port. This delay should be from 4-18 seconds. Repeat check. This will check the air intake time delay. Proceed with check to determine air exhaust time delay.

5. Remove Test Gage and plug intake port with Fill Valve J-21999 (female end).

6. Connect Test Gage to Superlift port and open air pressure (95 psi). Move overtravel lever approximately one inch up from neutral position as measured from end of lever, and hold for 15-20 seconds.

7. Quickly move overtravel lever downward two inches; at the same time begin timing number of seconds until air begins to escape from exhaust port. This delay should be 4-18 seconds. Repeat check.

If either delay is not within specification there has been either a loss of silicone fluid or a valve has lost its adjustment due to damage or wear. Silicone fluid may be replaced as described below.

d. Replacing Silicone Fluid

1. Remove control valve as described in Note 19a.

2. Clean exterior of valve thoroughly.

3. Position valve with delay plug on top. Remove delay plug and drain silicone fluid from chamber. Remove O-ring from plug and discard.

4. Remove cover plate retaining ring, using Snap Ring Pliers #3, J-4245. Remove delay cover from valve body.

5. Remove O-ring from chamber. Discard O-ring.

6. Place new O-ring over delay plug and install plug. Tighten to 20-30 inch-pounds.

7. Pour Silicone fluid into delay piston chamber until fluid level is 5/16 inch below top edge of body. Add or remove fluid with an eye-dropper until proper level is reached.

8. Hold control valve body in vise with delay chamber elevated slightly. Carefully operate lever to purge trapped air from fluid.

9. Place new O-ring in groove around delay piston bore, install cover and secure with snap ring, using Snap Ring Pliers #3, J-4245.

10. Place control valve vertically in vise with delay chamber down. Move overtravel lever up and down for one minute to vent air from delay piston pin chamber. Perform time delay check off car. If delay is not within 4-18 seconds,

recheck fluid level in delay chamber. If level is within specification, replace valve.

11. Install height control valve as outlined in Note 19b.

12. Proceed to Trim Adjustment On Car, Note 17.

19. Height Control Valve

a. Removal

1. Deflate system, using service valve.

2. Disconnect air lines at leveling valve intake and superlift ports.

3. Disconnect link from overtravel lever by removing one nut and lockwasher.

4. Remove two screws securing leveling valve to frame and remove leveling valve.

b. Installation

1. Install leveling valve with two screws, with time delay mechanism down.

2. Secure link to overtravel lever with one nut and lockwasher. On all convertible series cars, the link is secured to the lower hole. On all other series cars with standard springs, the link is also secured to the lower hole. If the car is not a convertible and has the special springs, the link is secured to the upper unmarked hole.

3. Connect air lines, white at control valve intake and black at Superlift port, Fig. 4-14, assembling tubing as described in Note 9.

4. Inflate reservoir to 140 psi or maximum pressure available through service valve.

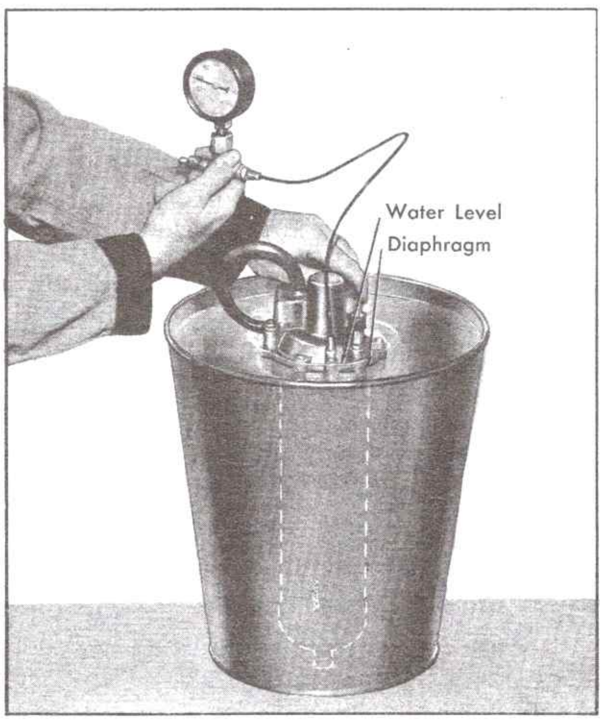


Fig. 4-15 Checking Compressor Assembly for Leaks

20. Leak Tests

a. Compressor, Reservoir and Regulator

1. Remove assembly, Note 12a or 26a.

2. Connect Test Gage to regulator. Inflate reservoir through service valve to 80-110 psi.

3. Route an eight inch rubber hose between vacuum and vent ports, Fig. 4-15.

4. While holding assembly in a vertical position with reservoir end down, immerse in water until the diaphragm is just submerged, Fig. 4-15. Do not submerge completely, as water can enter around the cover gasket. Observe for air leaks at

Reservoir weld seam

Reservoir to compressor O-ring. A stream of bubbles may appear in this area and then cease. The bubbles are caused by atmospheric air being purged from air pockets in the second stage housing. If the bubbles stop in 20 seconds or less there is no leak.

Regulator to compressor O-ring.

Regulator boot - defective internal O-ring.

Diaphragm between first and second stage housings - tightening through-bolts may correct the leak.

Service valve.

Test gage connections.

5. Remove hose from vacuum port and submerge disconnected end in water. Cover vacuum port with finger. Do not permit water to enter through vacuum port. If bubbles are evident, the probable cause is a defective second stage housing check valve.

6. Correct any leaks by either tightening screws or replacing parts.

7. If the cover gasket area is inadvertently submerged, remove cover and tilt unit so that water may drain through openings by distributor

valve mechanism. Move distributor valve from side to side until all water is purged. Blow dry with compressed air, both the distributor valve mechanism and the interior of the cover. Replace cover.

If the compressor passes this test, yet fails the output test, the compressor, reservoir and regulator need to be overhauled.

b. Control Valve

1. Remove control valve from car as described in Note 19a.

2. Clean exterior of control valve thoroughly.

3. Connect Test Gage J-22124 and air pressure source to intake adapter and open air pressure (80-110 psi).

4. Submerge unit in water. No air should escape if overtravel lever is in "neutral" position. If bubbles escape from Superlift port, replace control valve.

5. Shut off air pressure and detach test gage from air intake port. Plug intake port will Fill Valve, J-21999 (female end).

6. Connect Test Gage to Superlift port and open air pressure.

7. With overtravel lever in "neutral" position no air should escape. If bubbles escape from exhaust port, replace control valve.

8. If air escapes around edge of cover plate, the gasket must be replaced.

9. Remove control valve from water. Actuate overtravel lever to expel any water from unit.

10. Shut off air pressure and remove line from Superlift port.

c. Lines and Fittings

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position for maximum Superlift inflation and release.

3. Leak check all connections, with a soap and water solution. Leak test solution may also be used.

d. Superlifts

1. Disconnect lines and remove from car as described in Note 2a.

2. Inflate individually to 50-60 psi utilizing Fill Valves J-21999. Submerge in water and observe for leaks.

3. Install Superlifts as described in Note 2b.

21. Quick Check of Automatic Level Control System

NOTE: If check is performed when car is cold (15°F or less), time delay may be as much as 30 seconds.

1. Record rear trim height of empty car (measure from center of rear bumper to ground).

2. Add weight equivalent to two passenger load to rear of car. Car should begin to level in 4-18 seconds and final position should be approximately ± 1/2 inch of dimension measured above.

NOTE: If gas tank is nearly empty, a 3rd passenger's weight may be needed.

3. Remove weight. After 4-18 seconds car should begin to settle. Final unloaded position should be within approximately ± 1/2 inch of original measurement recorded in step 1.

DIAGNOSIS CHART (AUTOMATIC LEVEL CONTROL)

CONDITION	CAUSE	CORRECTION
Car loaded, will not raise.	External damage or breakage.	Visually inspect - Lines Link Control valve Superlifts
	Line leak.	Leak Test - Lines and fittings, Note 20c.

DIAGNOSIS CHART (CONT'D)
(AUTOMATIC LEVEL CONTROL)

CONDITION	CAUSE	CORRECTION
	Linkage to overtravel lever in wrong hole.	Lower hole in overtravel lever for convertible series only or cars with standard springs, Note 19b.
	Control valve setting incorrect.	Perform trim adjustment on car, Note 17.
	Defective component.	Perform system test, Note 10 and proceed as indicated.
Car loaded. Raises to level and then leaks down.	Line leak.	Leak test lines and fittings from control valve to Super-lifts and crossover line.
	Control valve exhaust leak.	Control valve test - on car, Note 18.
	Superlift leak.	Leak test Superlifts, Note 20d.
	Control valve leak.	Leak test - Control Valve Off Car, Note 20b.
Car loaded, raises partially.	Load excessive (over 500 lbs. at axle) on cars with special springs.	Distribute load, shift forward if practical.
	Control valve setting incorrect.	Perform trim adjustment on car, Note 17.
	Low supply pressure.	Perform compressor output test on car, Note 11.
Car unloaded, rides too high, will not come down.	Control valve setting incorrect.	Perform trim adjustment on car, Note 17.
	Improper springs.	Replace springs.
	External damage or breakage.	Visually inspect Lines Link Control valve Superlifts
	Linkage to overtravel lever in wrong hole.	Lower hole in overtravel lever for convertible series only or cars with standard springs, Note 19b.
	Defective control valve.	Control valve test, Note 18.
	Dirt in exhaust check valve port.	Dirt in exhaust check valve port.
Car rises when loaded but leaks down while driving.	Time delay mechanism not functioning properly.	Check time daily mechanism as described in Note 18c.

REAR SPRING CHART

Style	Color/Code		Normal Load	Rate Per Inch
68069, 68169 (All and 68367 (With Automatic Level Control)	Green	BE	1,175	92-98
68247 and 68347 (Without Automatic Level Control)	Gray	BC	1,300	111-119
68249, 68269, 68349, 68367 and 68369 (Without Automatic Level Control) .	Brown	BF	1,350	120-130
68247, 68249, 68269, 68347, 68349 and 68369 (With Automatic Level Control)	Orange	BJ	1,125	92-98
69723 and 69733	Chartreuse	BM	1,500	145-155
69347 (Leaf Spring)	Orange		965	105
69890 (Leaf Spring)	Yellow		1,900	223-247
Heavy Duty				
68069, 68169, 68247, 68249, 68269, 68347, 68349, 68367, and 68369 . .	Chartreuse	BM	1,500	145-155
69723 and 69733	Purple	BK	1,600	169-181
69890 (Leaf Spring)	White		2,120	223-247

CAR WEIGHTS AND STANDING HEIGHTS

Style	Observed Vehicle Weight**		Front Standing Height	Rear Standing Height* Standard Springs	Rear Standing Height* (w/Automatic Level Control Springs)
	Front	Rear			
68069 68169	2600 to 2700 lbs.	2325 to 2475 lbs.	4" - 4-3/4"		5-1/16" - 5-13/16"
68249, 69 68349, 69	2550 to 2650 lbs.	2225 to 2375 lbs.	3-15/16" - 4-11/16"	6" - 6-3/4"	5-1/16" - 5-13/16"
68247 68347	2550 to 2650 lbs.	2175 to 2325 lbs.	4" - 4-3/4"	5-7/8" - 6-5/8"	5-1/16" - 5-13/16"
68367	2550 to 2650 lbs.	2225 to 2375 lbs.	4" - 4-3/4"	5-7/8" - 6-5/8"	5-3/4" - 6-1/2"
69347	2750 to 2900 lbs.	1900 to 2000 lbs.	Note 34, Section 3		Note 34, Section 3
69723, 33	2900 to 3000 lbs.	2750 to 2850 lbs.	4-9/16" - 5-5/16"		5-3/4" - 6-1/2"
69890	2750 to 3000 lbs.	2900 to 3350 lbs.	4-9/16" - 5-5/16"	3-3/4" - 4-1/2"	

*Add 3/8" to front and rear standing height for unsettled springs on all styles except 69890. Add 3/8" to front standing height and 3/4" to rear standing height for unsettled springs on 69890. Series 69890 weights do not include extra equipment.

NOTE: On cars equipped with Automatic Level Control, first determine if the unit is working. This can be done by placing the weight of one man on the bumper. Rear of car should first lower and then raise after 4 to 18 seconds. If system is inoperative, it must be repaired and in full operation before checking rear standing height. See Note 10.

**For cars without air conditioning, subtract 125 lbs. from front end weight. Add 18 pounds to front end weight on cars equipped with air injection reactor system, and 10 lbs. for cars equipped with Automatic Level Control.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300-M	All Upper and Lower Control Link Bolts	1/2-13	90
1335	Rear Leaf Spring U-Bolt Nuts	1/2-20	45
1020	Rear Leaf Spring Front I-Bolt Nut.	1/2-20	70
1020	Rear Leaf Spring Shackle Nuts	1/2-20	70
286M	Self Locking Shock Attaching Nuts		35

NOTE: Refer to Back of manual, Page 16-1 for Bolt and Nut Markings, and Steel Classifications.

GENERAL DESCRIPTION

NOTE: The following information pertains only to the Fleetwood Eldorado.

The rear suspension, Fig. 4-16, on 693 series cars consists of two single leaf, semi-elliptical springs, two vertical and two horizontal shock absorbers.

The spring eyes are cushioned at each end by rubber bushings, and at the center spring clamp and rear axle by rubber insulating pads.

The shock absorbers used on 693 series cars are functionally the same as those used on the rear suspension of the other 1967 Cadillac models. The two horizontal shock absorbers help dampen the rear axle.

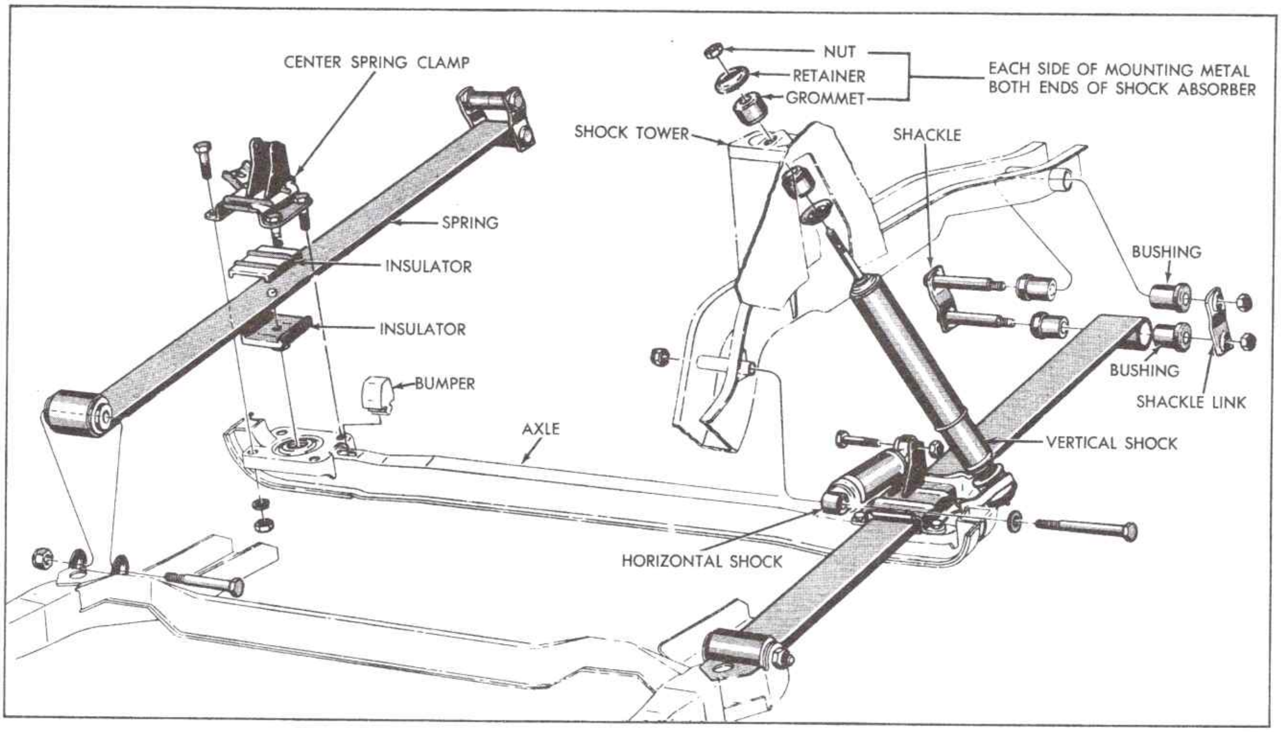


Fig. 4-16 Rear Suspension - 693

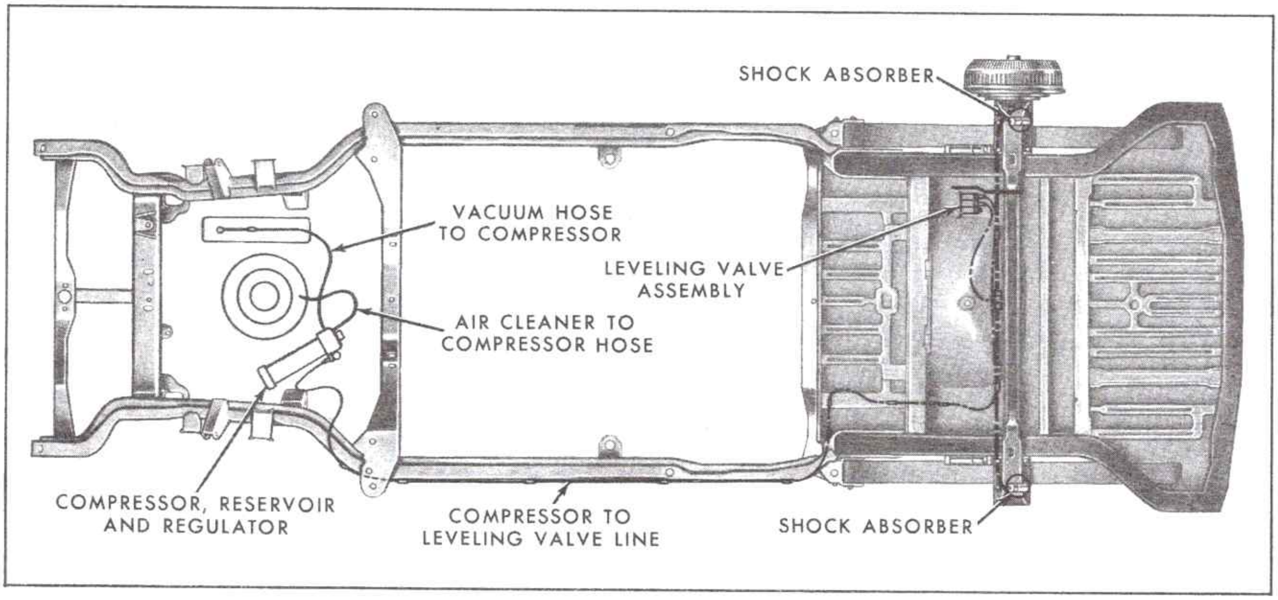


Fig. 4-17 Automatic Leveling System - 693

Automatic Level Control (Fig. 4-17)

Automatic pneumatic leveling is provided as standard equipment on 693 series cars. The system employed is basically the same as that used on other 1967 model Cadillacs and functions identically.

The major differences lie in the on-car location of the components, and that steel piping is used extensively in the rear axle area of 693 series cars. For additional information pertaining to the Automatic Level Control components, refer to the General Description in the forward portion of this section.

SERVICE INFORMATION

NOTE: The service information that follows pertains only to the Fleetwood Eldorado. For service procedures not given refer to the forward portion of the appropriate subsection, as these procedures are the same as for the other 1967 Cadillac models.

22. Rear Vertical Shock Absorber, (Fig. 4-16)

a. Removal

1. Raise rear of car and place jack stands under rear axle.

2. Remove rear wheel on side of car where shock absorber is to be replaced.

3. Disconnect Automatic Level Control, air line from fitting on shock absorber.

4. Working inside trunk compartment, remove upper retaining nut, retainer and grommet using a second wrench to prevent stem from turning.

5. Remove shock absorber lower retaining nut, retainer and grommet using a second wrench to prevent stem from turning.

6. Compress shock absorber, and remove grommet and retainer from upper stem, and remove shock absorber from car, and remove grommet and retainer from lower stem.

b. Installation

1. Install retainer and grommet on lower stem and insert lower stem through mounting hole on center spring clamp.

2. Install retainer and grommet on upper stem and guide upper stem into mounting hole in shock tower, expanding shock absorber as necessary to fully engage stems in mounting holes.

3. Install second grommet and retainer and retaining nut on lower stem, using a second wrench to hold stem from turning.

4. Working inside trunk compartment, install second grommet and retainer and retaining nut on upper stem, using a second wrench to hold stem from turning.

5. Connect Automatic Level Control air line to fitting on shock absorber as described in Note 9. Inflate reservoir to 140 psi or maximum pressure available.

6. Install rear wheel.

7. Remove jack stands and lower car.

23. Rear Horizontal Shock Absorber, (Fig. 4-16)

a. Removal

1. Raise rear of car and place on jack stands.

2. Remove nut and bolt securing rear of shock absorber to center spring clamp mounting flanges.

3. Remove nut and bolt securing front of shock absorber to frame and remove shock absorber.

b. Installation

1. Position shock absorber to mounts and install bolt and nut securing front of shock absorber to frame, tightening to 40 foot-pounds.

2. Install bolt and nut securing rear of shock absorber to flanges on center spring clamp, tightening to 40 foot-pounds.

3. Remove jack stands and lower car.

24. Rear Leaf Spring, (Fig. 4-16)

a. Removal

1. Raise rear of car and place on jack stands at frame pads.

2. Support rear axle at center with hydraulic jack.

3. Remove rear wheel from side of car where spring is to be removed.

4. Remove nut securing Automatic Level Control overtravel link to axle bracket and remove link from bracket.

5. Remove nut securing front of spring to frame bracket.

NOTE: Do not remove bolt at this time.

6. Remove two nuts retaining rear shackle outer link and remove outer link.

7. Remove four nuts and lockwashers securing center spring clamp to rear axle, and lift up on spring clamp, positioning it out of the way.

NOTE: Remove upper spring insulator from spring, if it did not remain in spring clamp.

8. Lower rear axle on hydraulic jack until axle is free from spring.

9. Remove rear shackle assembly from spring and body.

10. Remove bolt from front of spring and remove spring.

b. Installation

1. Install rear bushings in rear spring eye and in body, after lubricating bushings with tire mounting lubricant, if necessary.

2. Position front of spring to frame bracket and install bolt and nut securing spring to bracket. Do not torque at this time.

3. Position rear of spring to body and install rear shackle through spring eye and body hole.

4. Install outer link of shackle and two retaining nuts. Do not torque nuts at this time.

5. Position lower spring insulator on rear axle.

6. Using hydraulic jack, position rear axle to spring making certain that spring aligning pin locates into axle and that lower spring insulator is properly positioned.

7. Position upper spring insulator and center spring clamp to spring, aligning bolts with rear axle mounting bolts.

8. Install four lockwashers and nuts retaining rear axle to center spring clamp, tightening nuts to 30 foot-pounds.

9. Position Automatic Level Control overtravel lever link to axle mounting bracket and install retaining nut.

10. Install rear wheel previously removed.

11. Remove jack stands and lower car.

12. Torque rear shackle nuts to 40 foot-pounds and front spring attaching bolt to 75 foot-pounds.

25. Compressor, Regulator and Reservoir Assembly (693)

a. Removal

1. Raise hood.

2. For identification, place a piece of tape on air intake hose attached to compressor vent port, and deflate system through service valve, Fig. 4-9.

3. Remove air intake and vacuum hoses from compressor fittings.

4. Remove high pressure line from regulator fitting.

5. Loosen clamps securing compressor to cowl-to-wheel housing strut, and slide clamps away from mounting brackets and remove assembly from car.

6. Remove nuts and lockwashers securing mounting brackets to flexible mounts on compressor assembly and remove mounting brackets.

b. Installation

1. Position mounting brackets to flexible mounts and secure with lockwashers and nuts.

2. Position mounting brackets to cowl-to-wheel housing strut, with compressor end of assembly toward dash, and slide clamps over mounting brackets.

3. Install high pressure line on regulator fitting, following procedure described in Note 9.

4. Install previous identified air inlet hose to vent fitting, Fig. 4-9.

5. Install vacuum hose to vacuum fitting.

6. Reposition assembly as necessary, and tighten clamps securing assembly to strut.

7. Inflate reservoir to 140 psi or maximum pressure available through service valve.

8. Lower hood.

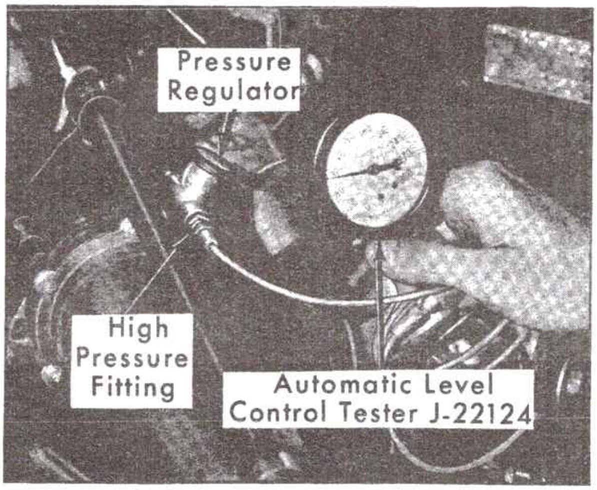


Fig. 4-18 Testing Compressor Output - 693

26. Height Control Valve— (693)

a. Removal

1. Deflate system, using service valve.

2. Disconnect intake and superlift air lines from fittings on control valve, Fig. 4-19.

3. Disconnect link from overtravel by removing one nut and lockwasher.

4. Remove two nuts, lockwashers and bolts securing control valve mounting bracket to bracket on wheel well and remove control valve.

b. Installation

1. Position control valve, with time delay mechanism down, mounting bracket to bracket on wheel well, and secure with two bolts, lockwashers and nuts.

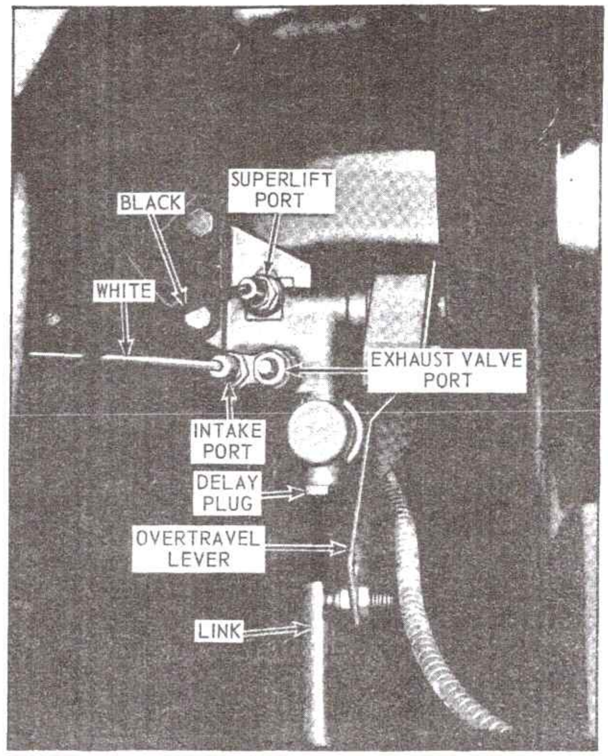


Fig. 4-19 Height Control Valve

2. Secure link to overtravel lever with lockwasher and nut.

3. Connect air lines at control valve intake and superlift fittings, Fig. 4-19, as described in Note 9.

4. Inflate reservoir, through service valve, to 140 psi or maximum pressure available.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
1111	Vertical Shock Absorber Nuts	3/8-24	8
301-M	Horizontal Shock Absorber Nuts	7/16-14	40
286-M	Center Spring Clamp-to-Rear Axle Nuts . . .	3/8-16	30
286-M	Rear Leaf Spring Shackle Nuts	7/16-14	40
301-M	Rear Leaf Spring Front Mounting Nut	1/2-13	75

PROPELLER SHAFT

GENERAL DESCRIPTION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

Propeller Shaft—680, 681, 682 and 683

A one-piece propeller shaft assembly, Fig. 4-20, is used on all 1967 model Cadillac cars except the Fleetwood Seventy-Five Sedan and Limousine, and the Commercial Chassis. The one-piece propeller shaft used on the Fleetwood Sixty-Special Sedan, however, is longer and slightly larger in diameter due to the longer wheel base of this body style.

Two constant velocity type universal joint assemblies are used on the one-piece propeller shaft; one in front and one in the rear. A constant velocity universal joint assembly consists of two single joints connected with a special link yoke. A centering ball and socket between the joints maintains the relative position of the two units. This centering device causes each of the two units to operate through one-half of the complete angle between the propeller shaft and transmission and the propeller shaft and differential carrier. The one-piece propeller shaft is serviced as a complete assembly.

This propeller shaft assembly is attached to the differential carrier by means of a double flange connection. A flange on the rear universal joint attached to a flange on the differential carrier pinion by four screws and lockwashers. The assembly is attached to the transmission by means of an internally splined ball stud support slip yoke.

697

A two-piece propeller shaft assembly, Fig. 4-21, that uses three constant velocity type universal joint assemblies, is used on Fleetwood Seventy-Five Sedans and Limousines. Constant velocity universal joint assemblies are located at each end and in the center of the propeller shaft assembly.

On the front end of the rear section of the propeller shaft assembly is a splined slip yoke that fits into a splined coupling in the rear end of the front section of the propeller shaft assembly. This slip spline permits the slight lengthening and shortening of the propeller shaft assembly required by the movement of the rear axle.

The propeller shaft assembly is attached to the transmission by means of a front slip yoke, and attached to the differential carrier pinion by means of the double flange connection previously described. In addition, this propeller shaft assembly is supported in the center by a center bearing support and bracket assembly located on a frame crossmember.

With the exception of the center bearing and support, this propeller shaft is serviced as a complete assembly.

698

A two-piece propeller shaft assembly, Fig. 4-26, that uses three standard universal joints, is used on the Commercial Chassis. Standard universal joints are located at each end and in the center of the propeller shaft assembly.

The standard universal joints used on the Commercial Chassis are replaceable, but cannot be repacked. On original universal joints, the injected nylon ring that retains the bearing cup in the yoke will shear off when the bearing is removed. There are no provisions for replacing the nylon ring other than installing a new universal joint with the conventional snap ring retainers.

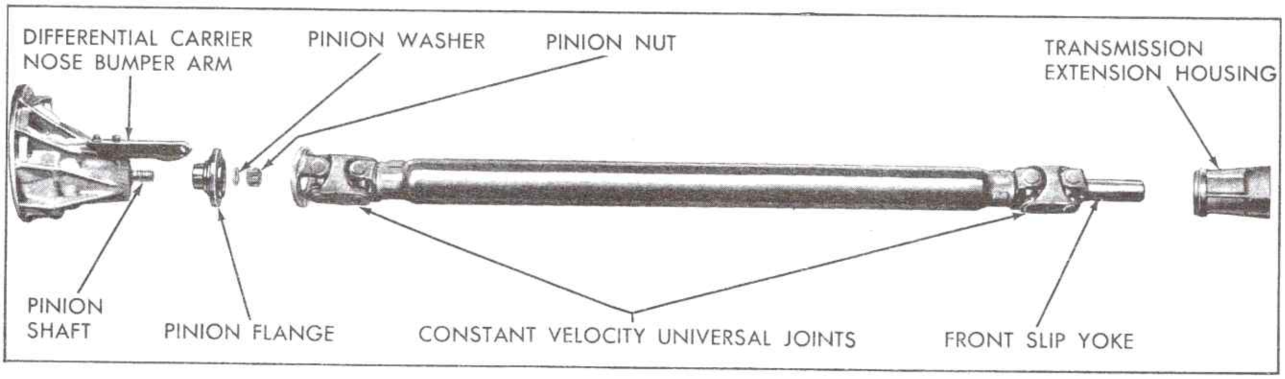


Fig. 4-20 Propeller Shaft (680-1-2-3)

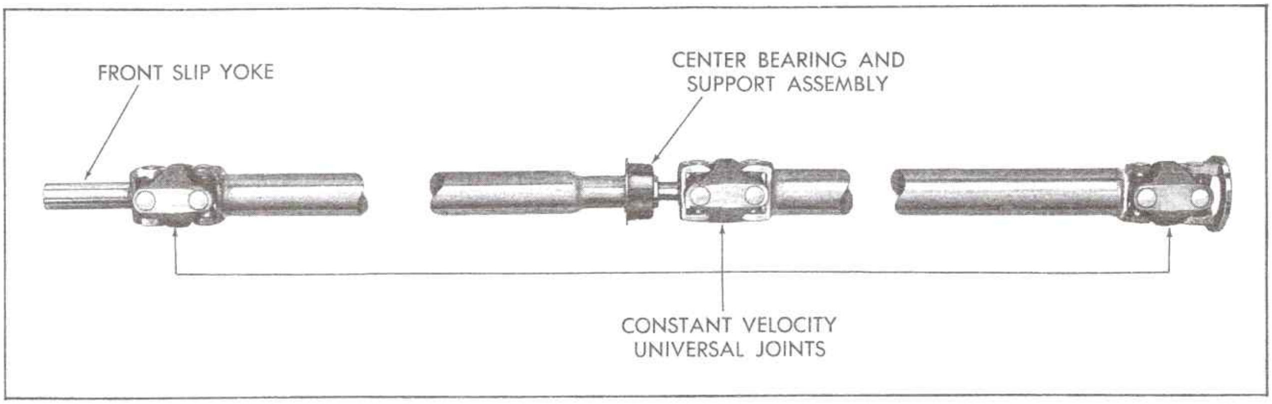


Fig. 4-21 Propeller Shaft (697)

The only time disassembly is recommended is when the universal joint should be replaced, because it has become loose, worn or noisy.

The front and rear sections of this propeller shaft assembly are splined together in the same manner as the propeller shaft assembly used on Fleetwood Seventy-Five Sedans and Limousines.

The propeller shaft assembly on the Commercial Chassis is attached in the same manner as described for 697 series cars. However, on 698 series cars, the propeller shaft assembly is supported in the center by an adjustable center bearing support and bracket assembly located on a frame crossmember. The center bearing support is adjustable to compensate for various load conditions.

SERVICE INFORMATION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

27. Slip Yoke Maintenance— One Piece Propeller Shaft

The propeller shaft slip yoke does not require a periodic maintenance interval. However, if stickiness should develop at the slip yoke on one-piece propeller shaft cars at high mileage, the slip yoke should be serviced.

To service slip yoke, remove propeller shaft from car. Thoroughly clean slip yoke with washing gas or kerosene. Lubricate inside diameter of slip yoke with approximately two tablespoons of synthetic oil seal lubricant, and outside diameter with type "A" transmission oil. This service procedure should also be followed whenever propeller shaft is removed from car.

28. Propeller Shaft Assembly— All Except 697 and 698

a. Removal

1. Position car on hoist. Place transmission selector lever in Park to keep propeller shaft from turning, and raise car on hoist.

2. Remove from rear universal joint flange two of the four attaching screws and lockwashers that are accessible.

3. Disconnect linkage at transmission, and shift transmission into Neutral position.

4. Rotate propeller shaft to gain access to remaining two flange attaching screws. Shift transmission back to Park position.

5. Remove remaining two flange attaching screws and lockwashers from rear universal joint flange.

CAUTION: After removing the four flange screws, secure propeller shaft to lower right hand control arm with wire. Do not permit the propeller shaft to be supported by the front constant velocity universal joint only.

6. Remove propeller shaft by pushing shaft forward so that rear universal joint flange clears pinion shaft, then remove shaft by pulling rearward to disengage slip yoke.

7. Install cardboard shipping cover, or similar protective device, on front slip yoke to keep slip yoke as clean as possible.

8. Install spare yoke into transmission extension housing to prevent loss of oil.

b. Installation

1. Remove any nicks, burrs or dirt from differential carrier pinion flange and from mating flange on rear constant velocity joint.

2. Remove cardboard cover and clean slip yoke, if necessary, avoiding the use of anything that may scratch or damage yoke. Lubricate I.D. of slip yoke with approximately two tablespoons of synthetic oil seal lubricant, and O.D. with type "A" transmission fluid.

3. Remove spare yoke previously installed in transmission extension housing, and install slip yoke on transmission output shaft.

4. Position propeller shaft to differential carrier, and connect rear universal flange to pinion flange with two attaching screws and lockwashers. Torque screws to 65 foot-pounds.

CAUTION: Do not use a pry bar or heavy tool to hold propeller shaft when tightening flange attaching screws, as universal joint bearing seals would be damaged.

5. Shift transmission into Neutral position and rotate propeller shaft to gain access to two remaining screw holes.

6. Shift transmission back into Park position.

7. Install remaining two attaching screws and lockwashers at rear universal joint flange. Torque screws to 65 foot-pounds.

8. Connect linkage at transmission.

9. Lower car on hoist.

10. Check transmission oil level as described in Section 7, Note 7a.

29. Propeller Shaft Assembly— 697 and 698

a. Removal

1. Position car on hoist. Place transmission selector lever in Park to keep propeller shaft from turning, and raise car on hoist.

2. On 698 series cars, mark position of the center support with respect to the frame cross member.

3. Remove from rear universal joint flange two of the four attaching screws and lockwashers that are accessible.

4. Disconnect linkage at transmission, and shift transmission into Neutral position.

5. Rotate propeller shaft to gain access to remaining two flange attaching screws. Shift transmission back to Park position.

6. Remove remaining two flange attaching screws and lockwashers from rear universal joint flange.

CAUTION: After removing the four flange screws, secure propeller shaft to lower right hand control arm with wire. Do not permit the rear section of propeller shaft to be supported by the center universal joint only.

7. Remove the two center bearing support-to-frame bolts, nuts and lockwashers and push propeller shaft forward so that rear universal joint flange clears pinion shaft.

8. Slide propeller shaft rearward until front yoke comes off of transmission output shaft and install cardboard shipping cover, or similar protective device, on front yoke.

NOTE: The cardboard cover will prevent nicking of the yoke during removal as well as keeping the yoke as clean as possible.

9. Withdraw propeller shaft through frame cross member, removing it from the rear.

10. Install a spare yoke into transmission extension housing to prevent oil loss.

b. Installation

1. Remove cardboard cover and clean slip yoke, as necessary. Avoid using anything that may scratch or damage yoke.

2. Replace cardboard cover on yoke.

3. Remove any nicks, burrs or dirt from differential carrier pinion flange and from mating flange on rear universal joint.

4. Slide propeller shaft assembly through frame cross member from rear of car.

5. Remove cardboard cover from front yoke and lubricate yoke with type "A" transmission fluid.

6. Remove spare yoke previously installed in transmission extension housing and install front yoke on transmission output shaft.

7. Position propeller shaft to differential carrier, and connect rear universal flange to pinion flange with two attaching screws and lockwashers. Torque screws to 65 foot-pounds.

CAUTION: Do not use a pry bar or heavy tool to hold propeller shaft when tightening flange attaching screws, as universal joint bearing seals would be damaged.

8. Shift transmission into Neutral position and rotate propeller shaft to gain access to two remaining screw holes.

9. Shift transmission back into Park position.

10. Install remaining two attaching screws and lockwashers at rear universal joint flange. Torque screws to 65 foot-pounds.

11. On 698 series cars, relocate center support to its original position to the frame cross member as marked before removal.

12. Install two center bearing support-to-frame bolts, nuts and lockwashers. Torque nuts to 16 foot-pounds.

13. Connect linkage at transmission.

14. Lower car on hoist.

15. Check transmission oil level as described in Section 7, Note 7a.

30. Propeller Shaft Front Slip Yoke Leak Test—697 and 698

1. Remove propeller shaft as described in Note 29a.

2. Hold open end of yoke up and fill with washing gas or kerosene.

CAUTION: Use of cleaning solvents, other than those recommended, may cause damage to the seal.

3. Check area around yoke plug for signs of leaking.

4. If plug is loose or leaks, install new propeller shaft assembly on 697 series cars. On 698 series cars, install new slip yoke and front universal joint assembly.

5. After leak test, remove all traces of washing gas or kerosene with compressed air.

6. Install propeller shaft as described in Note 29b.

31. Propeller Shaft Center Bearing Support Adjustment—698

On cars equipped with standard universal joints, propeller shaft vibrations may occur as the car is driven under differing loading conditions. These vibrations are more noticeable at low speed acceleration (10 to 40 MPH). Because the weight of the commercial chassis series varies considerably, according to its application, the center bearing support is adjustable to compensate for various loads. The support is positioned in the lowest adjusting hole for light loads at the factory. To correct propeller shaft vibration on commercial chassis cars, proceed as follows:

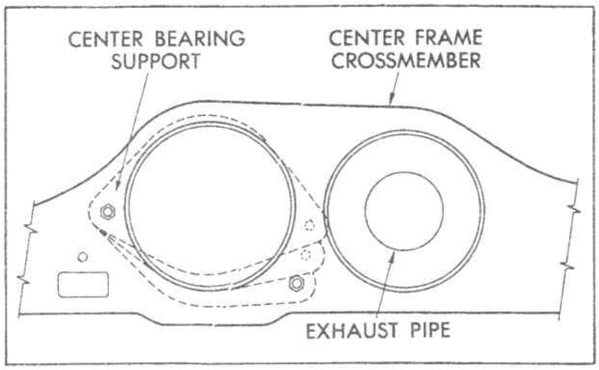


Fig. 4-22 Adjusting Center Bearing Support (698)

1. Measure rear standing height as described in Note 1, except measure the height under operating conditions with driver and operating equipment loaded in car.

2. Remove adjusting bolt and lockwasher from frame center cross member, Fig. 4-22, and loosen pivot bolt. Align center bearing support with center frame cross member as determined from the following table and install bolt and lockwasher. Torque bolts evenly to 16 foot-pounds.

*Rear Standing Height	Support Alignment Position
Below 1-3/4 inch	Top
1-3/4 inch to 3-1/2 inch	Center
3-1/2 inch to 5-1/4 inch	Lowest
Above 5-1/4 inch	Lowest, and shim as described in step 3.

*With driver and operating equipment loaded in car.

3. If rear standing height (as determined under conditions outlined in step 1), is above 5-1/4 inches, the rear of engine may be raised by adding shims of equal thickness on both sides of rear engine support cross member between frame extension and support cross member. Rear of engine may be shimmed equally any distance up to 3/8 inch. Do not shim between support and transmission as this point is already shimmed at

the factory. (Longer cross member bolts may be required.)

4. After raising engine by shimming, check the drive line to make sure there is sufficient operating clearance.

32. Standard Universal Joints—698

Disassembly and repacking of the universal joints should not be attempted. Disassembly is recommended only when joint is loose, worn or noisy, and then universal joint should be replaced. When an original universal joint has been disassembled, it cannot be reassembled because there are no provisions for replacing the injected nylon ring between the bearing cup and yoke. Disassembly and repacking of replacement joints is not recommended because changes in the normal wear pattern on the needles will result in premature wear and eventual failure.

NOTE: Constant velocity type universal joints are not serviced separately from propeller shaft assembly. The following procedure pertains to standard universal joints used on Commercial Chassis.

a. Removal

1. Remove propeller shaft assembly as described in Note 29a.

2. If universal joint being removed is a replacement joint, remove lock rings from bearings. On original universal joints, the injected nylon ring will shear off when bearing is removed.

3. Scribe alignment marks on yoke and shaft so that shaft parts can be reassembled with original indexing.

4. Support yoke or bearing trunnion on vise jaws, position Bearing Remove, J-4174, over end of bearing cup, and pound on remover tool with a hammer until bearing is driven out of yoke and into remover tool about 1/2 inch, Fig. 4-23.

NOTE: Only one size universal joint bearing is used. Use Bearing Remover, J-4174, for removing bearings.

5. Place Bearing Remover with bearing in vise. Tighten vise until bearing is held securely by tool, then drive yoke away from tool until bearing is removed, Fig. 4-24.

6. Repeat steps 3 to 5 on other bearings. Remove and discard universal joint cross.

b. Installation

1. Start one bearing and seal assembly into propeller shaft yoke by tapping lightly with a hammer, being careful not to dislocate needles in bearing.

2. Check holes in ends of cross arms, making certain they are filled with universal joint grease.

3. Install universal joint cross in position and guide into bearing already started.

4. Start opposite bearing into propeller shaft yoke and place in vise with jaws against bearings, Fig. 4-25.

5. Tighten vise until cross is just ready to enter opposite bearing and adjust position of cross until it enters both bearings.

6. Tighten vise until both bearings are in far enough to allow lock rings to be installed.

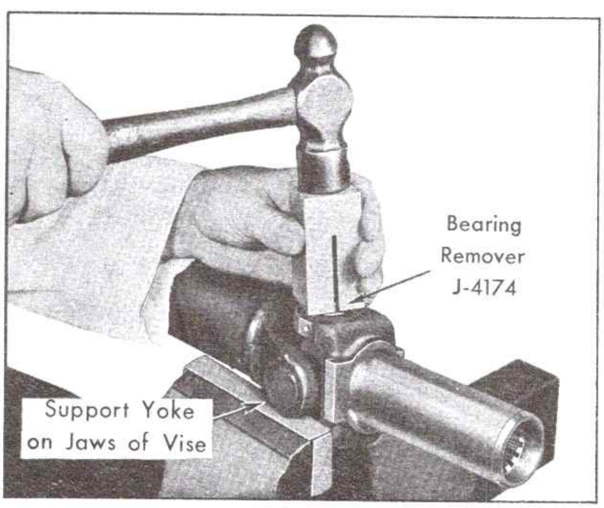


Fig. 4-23 Installing Bearing Remover Tool

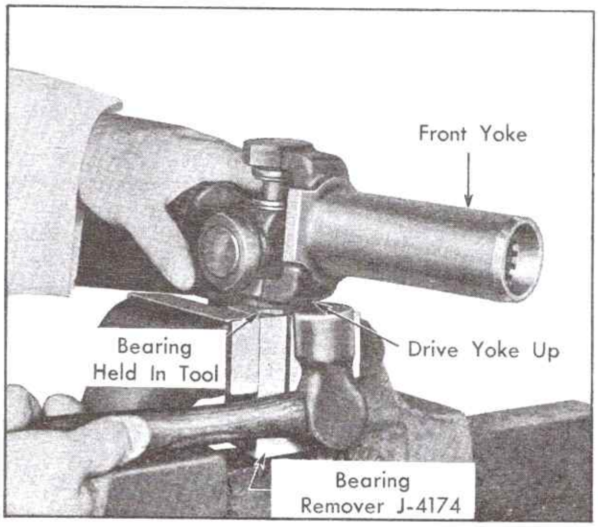


Fig. 4-24 Removing Universal Joint Bearing

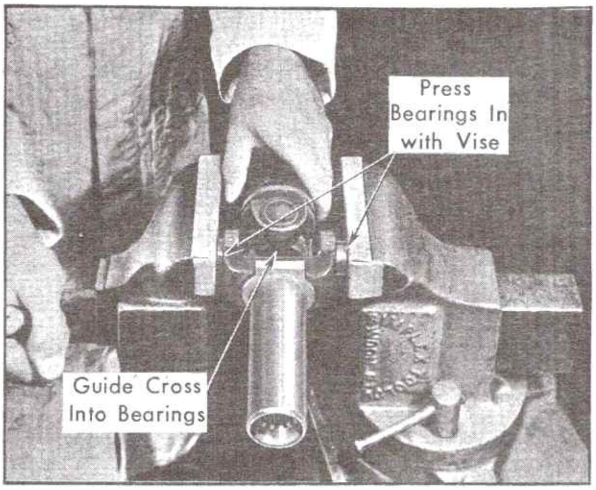


Fig. 4-25 Installing Universal Joint Bearing

NOTE: If bearings do not go into position with normal pressure on the vise, a needle bearing may have fallen out of place. Remove bearing and reposition needle.

CAUTION: Whenever all needles are removed from bearing assembly, make certain that ring is installed in bottom of bearing cup before installing needles.

7. Install lock rings, making certain that they are properly seated in groove.

8. Repeat above procedure on remaining bearings.

NOTE: Make certain that scribe mark on yoke aligns with scribe mark on shaft.

9. Install propeller shaft assembly as described in Note 29b.

33. Front and Rear Propeller Shaft Sections—697 and 698

a. Disassembly

1. Remove propeller shaft assembly as described in Note 29a.

2. Pry up center bearing lock retainer, Fig. 4-26.

3. Back off center bearing retainer nut, using Center Bearing Retaining Nut Remover and Installer, J-21009, and separate front and rear propeller shafts by sliding front shaft off center slip yoke.

4. Remove and discard center bearing lock retainer.

5. Remove center slip yoke seal, split washer, and center bearing retaining nut from slip yoke. Discard seal and split washer.

b. Assembly

1. Clean inner spline of front propeller shaft and spline of center slip yoke.

2. Install center bearing retaining nut on slip yoke with threaded end toward front propeller shaft.

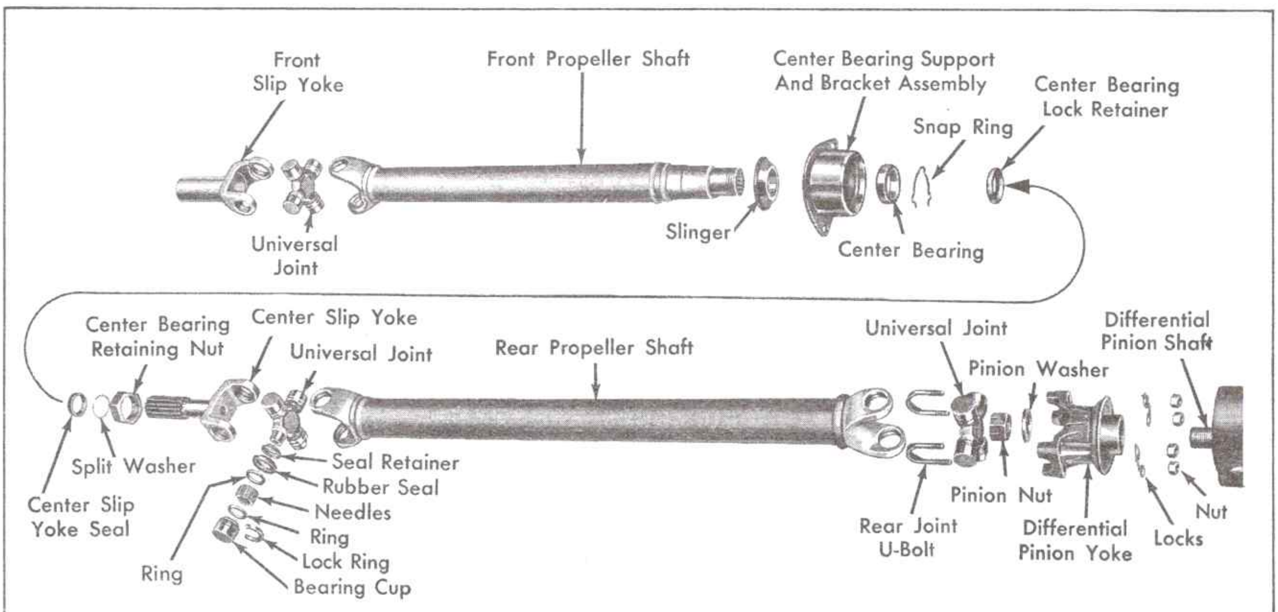


Fig. 4-26 Propeller Shaft Disassembled (698)

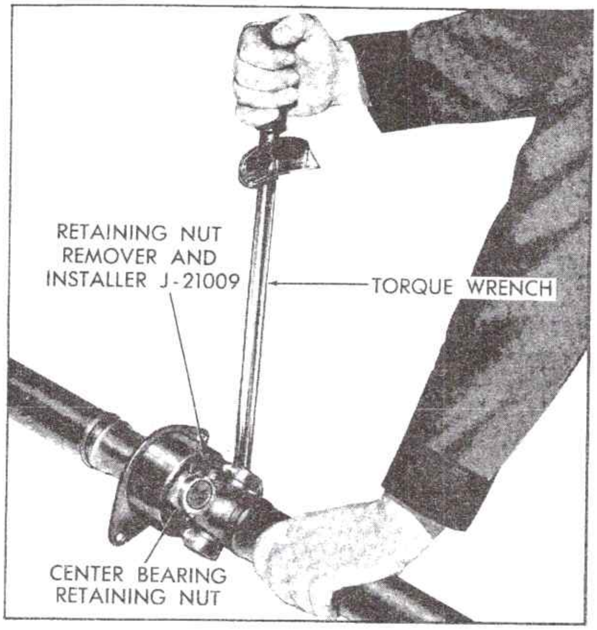


Fig. 4-27 Tightening Center Bearing Retainer Nut

3. Install new split washer, being sure to slide washer securely against inner shoulder of retaining nut.

4. Slide new slip yoke seal over center slip yoke and into retaining nut.

5. Install new center bearing lock retainer on center slip yoke.

6. Coat inner spline of front propeller shaft and spline of center slip yoke with center bearing slip yoke lubricant available from servicing Parts Warehouses.

7. Align wire clip on end of center slip yoke with missing land on inner spline of front shaft and slide center slip yoke into front propeller shaft spline.

8. Tighten center bearing retaining nut to 55 foot-pounds using Center Bearing Retaining Nut Remover and Installer J-21009, and a torque wrench, Fig. 4-27.

CAUTION: Particular care should be taken in application of torque wrench and installer tool, to prevent over-torquing the nut. Hold torque wrench perpendicular to installer tool to cancel off-set error on torque reading.

9. Bend edge of center bearing lock retainer in two places to lock center bearing retaining nut.

10. Install propeller shaft assembly as described in Note 29b.

34. Propeller Shaft Center Bearing—697 and 698

a. Removal

1. Remove propeller shaft assembly as described in Note 29a.

2. Disassemble front and rear propeller shafts as described in Note 33a.

3. Remove center bearing support and bracket assembly from front propeller shaft by tapping on front side of assembly with a soft head hammer.

4. Remove slinger from end of propeller shaft.

5. Pry out snap ring from open side of bearing retainer and remove bearing from support bracket by tapping lightly from rear with a soft head hammer.

b. Installation

1. Install bearing into bearing retainer, pressing on outer race of bearing only. Use care not to damage bearing or support, and secure bearing in retainer with snap ring.

2. Pack front and rear face of center bearing with heavy duty water pump grease.

3. Install slinger on front propeller shaft.

4. Position center bearing support assembly on rear of front propeller shaft with snap ring facing front end of shaft, on Fleetwood Seventy-Five Sedans and Limousines and rear end of shaft on Commercial Chassis. Tap entire assembly onto front shaft until it fits securely against shoulder.

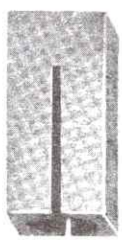
5. Assemble front and rear propeller shafts as described in Note 33b.

6. Install propeller shaft assembly as described in Note 29b.

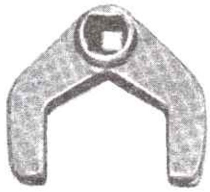
TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300-M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16-20	65
Special	Prop Shaft Center Bearing Retaining Nut (697 and 698)	1-9/16-18	55
300M	Center Bearing Support Bolts (697 and 698) .	5/16-24	16

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.



J 4174 UNIVERSAL JOINT BEARING REMOVER



J 21009 CENTER BEARING RETAINING NUT REMOVER AND INSTALLER

Fig. 4-28 Special Tools

REAR AXLE

GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado refer to the latter portion of the appropriate subsection.

The rear axle housing used on 1967 model Cadillac cars is of a five piece design that minimizes the weight while providing an optimum amount of surface area for cooling efficiency.

The housing has six attaching brackets; two for the rear lower control links, two for the rear upper control links and two for the rear springs. The 698 series cars, however, have spring pads in place of the two spring attaching brackets.

The axle housing has a vent fitting located on the left hand side to prevent internal pressure from building up.

Greased and sealed rear wheel bearings are used on 1967 model Cadillac cars. The bearings are sealed on the outer side by a rubber grease seal that is an integral part of the bearing. The inner oil seal, however, can be serviced separately from the bearing. The rear wheel bearings require no periodic lubrication or adjustment. Sealing between the outer diameter of the bearing and inner diameter of the axle housing is accomplished by an O-ring seal that should be replaced whenever the axle shaft and bearing assembly is removed.

SERVICE INFORMATION

35. Rear Axle Backlash Measurement

1. Place car on hoist.

2. To prevent rotation of pinion flange or yoke, use corresponding holding tool, and clamp tool handle to lower control link.

3. Pull parking brake cable on one wheel to prevent wheel from turning. (This is not necessary on cars equipped with a Controlled Differential).

4. Measure rotation (backlash) of opposite wheel in inches at outer circumference of tire tread. A stiff wire pointer fastened to the fender or car frame will aid in this measurement. Maximum backlash under this condition should not exceed 1/2 inch on standard differentials and 1/8 inch on Controlled Differentials.

36. Rear Wheel and Brake Drum

a. Removal

1. Raise rear end of car, place jack stands under rear frame rails, and remove wheel.

NOTE: Remove wheel spacer in 698 Series vehicles.

2. Remove one screw holding brake drum to axle shaft flange.

3. Remove brake drum.

b. Installation

1. Install brake drum on rear axle shaft flange and secure with one screw.

NOTE: Install wheel spacer on 698 Series vehicles.

2. Install wheel and replace wheel mounting nuts.

3. Remove jack stands, lower car and tighten wheel nuts to 105 foot-pounds.

37. Axle Shaft, Bearing Oil Seal, and Wheel Bearing

a. Removal of Axle Shaft and Bearing Assembly

1. Raise rear end of car and remove wheel and brake drum as described in Note 36a.

2. Remove four nuts and lockwashers that hold cover, gasket, and backing plate to rear axle housing, Fig. 4-29.

3. Install Axle Shaft Puller, J-8131, on studs of rear axle shaft flange and install Slide Hammer Assembly, J-2619, in Puller, Fig. 4-30.

4. Drive outward with slide hammer to remove axle shaft assembly. Remove and discard cover gasket.

b. Replacing Rear Wheel Bearing Oil Seal

NOTE: Step 1 pertains to 698 style vehicles only, for all other styles proceed to step 2.

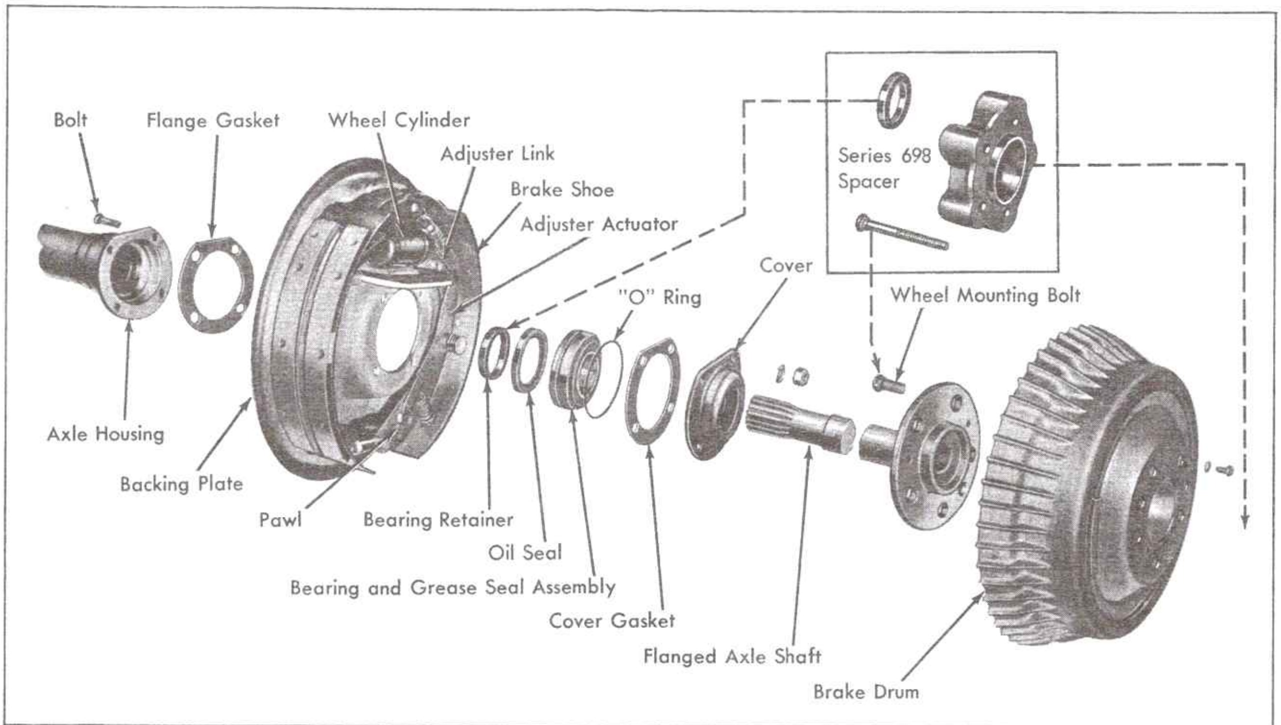


Fig. 4-29 Rear Wheel Disassembled

1. If procedure is being performed on 698 style vehicle, proceed as follows:

a. Center punch location of drill holes on bearing retainer, following layout illustrated in Fig. 4-31.

b. Drill two 1/4 inch holes, 1/2 inch deep, into side of bearing retainer, Fig. 4-31.

CAUTION: Use extreme care to avoid drilling holes more than 1/2 inch deep, as axle shaft would be damaged.

2. Using a cold chisel and hammer, notch bearing retainer next to bearing, being careful not to damage bearing.

NOTE: Bearing retainer need not be completely split. Drive chisel into retainer only until retainer can be slipped off shaft, then remove retainer.

3. Wipe shaft and bearing clean.

4. Remove oil seal from bearing using Oil Seal Remover, J-21010, Fig. 4-32. Hook slotted flange of remover tool under rolled edge of seal case and pry up on tool handle. Then slide seal off axle shaft.

NOTE: If bearing grease has been diluted by axle oil, drain and wipe out oil.

5. Squeeze contents of tube of wheel bearing

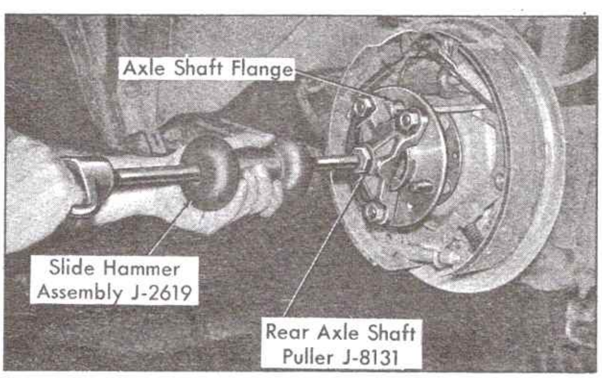


Fig. 4-30 Removing Rear Axle Shaft

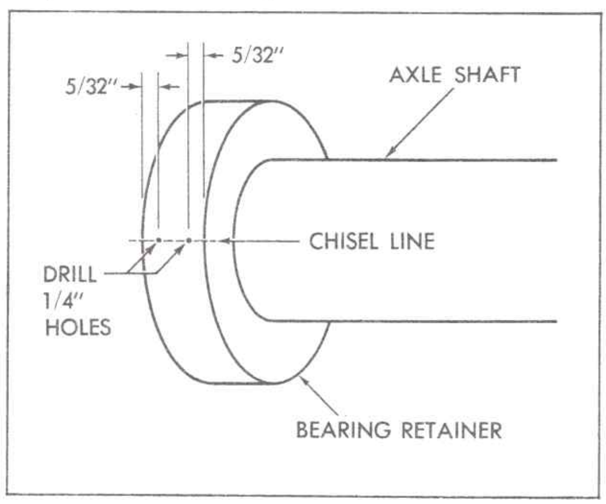


Fig. 4-31 Removing Bearing Retainer (698)

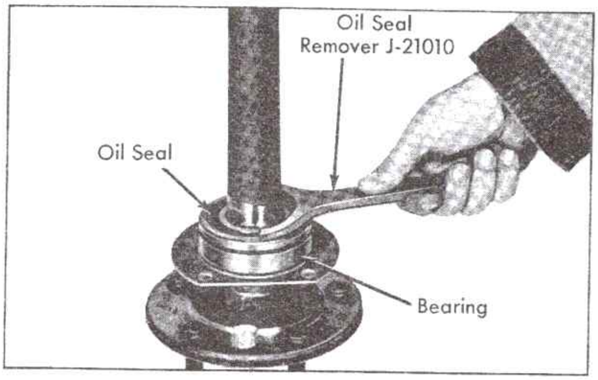


Fig. 4-32 Removing Oil Seal from Bearing

grease included in seal replacement kit inside the bearing. Also apply a thin film of grease around lip of seal.

6. Install new oil seal on axle shaft with spring side of seal toward splined end of shaft. Position seal in bearing and press seal into bearing using Oil Seal Installer, J-21011, as a slide hammer, Fig. 4-33, until metal case of seal is flush with top of bearing.

NOTE: Seal may also be installed by letting installer tool slide down axle shaft under its own weight.

7. Install new bearing retainer on axle shaft. Insert axle shaft through ring of Bearing Installer, J-6257, and U-shaped piece of Bearing Plate and Pin Assembly, J-2986-1, and place on arbor press.

8. Press shaft through retainer until retainer

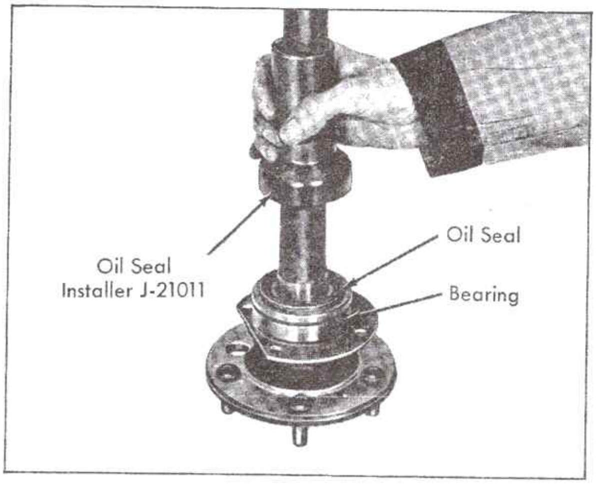


Fig. 4-33 Installing Oil Seal in Bearing

just contacts bearing. Remove shaft assembly from installer tools.

c. Replacing Rear Wheel Bearing and Seal Assembly

NOTE: Step 1 pertains to 698 style vehicles only, for all other styles proceed to step 2.

1. If procedure is being performed on 698 style vehicle, proceed as follows:

a. Center punch location of drill holes on bearing retainer, following layout illustrated in Fig. 4-31.

b. Drill two 1/4 inch holes, 1/2 inch deep, into side of bearing retainer, Fig. 4-31.

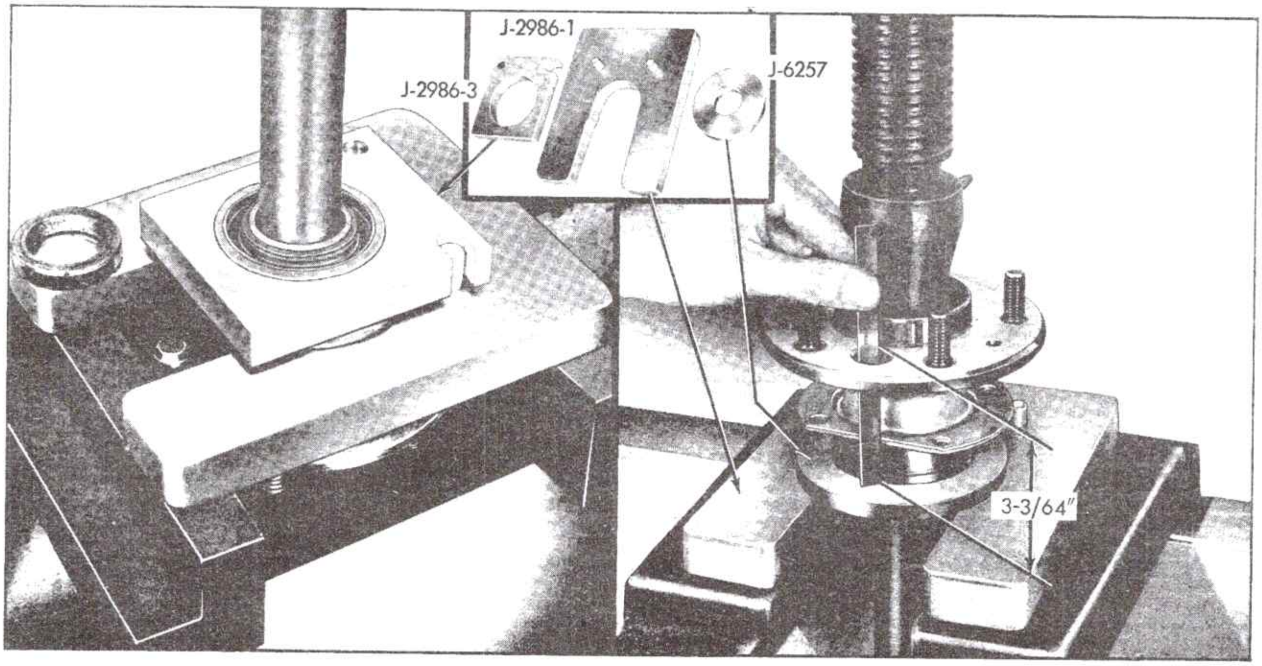


Fig. 4-34 Removing and Installing Rear Wheel Bearing

CAUTION: Use extreme care to avoid drilling holes more than 1/2 inch deep, as axle shaft would be damaged.

2. Using a cold chisel and hammer, notch bearing retainer next to bearing.

NOTE: Bearing retainer need not be split. Drive chisel into retainer only until retainer can be slipped off shaft, then remove retainer.

3. Place rear axle shaft and bearing assembly in U-shaped piece of Rear Wheel Bearing Plate and Pin Assembly, J-2986-1, and position on arbor press.

CAUTION: Make certain that axle shaft flange is properly centered in arbor press and free from any obstructions.

4. Install Rear Wheel Bearing Holding Tool, J-2986-3, around bearing and over dowels, Fig. 4-34.

CAUTION: Step 3 must be performed to decrease danger of bearing exploding while under arbor press load.

5. Press axle shaft through bearing and remove bearing.

NOTE: If rear wheel bearing has been removed because of failure inspect axle housing and differential carrier for metal chips, and clean thoroughly if necessary.

6. Inspect cover for damage. Replace if necessary.

7. Install new wheel bearing and seal assembly on shaft so that O-ring groove is toward splined end of axle shaft.

8. Insert axle shaft through ring of Bearing Installer, J-6257, and U-shaped piece of Bearing Plate and Pin Assembly, J-2986-1, and place on arbor press, Fig. 4-34.

9. Press bearing on shaft so that there is 3-3/64 inch clearance between outer surface of axle shaft flange and inner end of wheel bearing inner race, Fig. 4-34.

10. Release arbor press and remove axle shaft from installer tools.

11. Install new bearing retainer on axle shaft and reinstall shaft on installer tools.

NOTE: Install ring with chamfer toward bearing.

12. Press shaft through retainer until retainer just contacts bearing. Remove shaft from installer tools.

d. Installation of Axle Shaft and Bearing Assembly

1. Apply film of differential lubricant to wheel bearing bore in axle housing after checking for burrs and nicks.

2. Lubricate O-ring seal. Use a new gasket on cover and a new O-ring seal on wheel bearing and install axle shaft, being careful not to damage O-ring seal.

NOTE: Whenever axle shaft is removed, always install a new O-ring seal on wheel bearing.

3. Install four nuts and lockwashers on rear axle housing bolts, to hold cover, gasket, and brake backing plate in place, and tighten by inserting a socket wrench through large hole in rear axle flange. Torque nuts to 40 foot-pounds.

4. Install brake drum and one retaining screw.

5. Install wheel and lower car. Torque wheel mounting nuts to 105 foot-pounds.

SPECIFICATIONS

Item	All Styles Unless Otherwise Noted
Axle Shaft Length	
Left Side	29-23/32"
Right Side	32-21/64"
Axle Shaft Run-Out (at ground surface near splines)	.006" Maximum
Outer Surface of Axle Shaft Flange to Inner End of Wheel Bearing Inner Race	3-3/64"

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
286-M	Brake Backing Plate to Axle Housing Nuts	3/8-24	40
286-M	Differential Carrier to Axle Housing Nuts	3/8-24	37
1111	Wheel Mounting Nuts	1/2-20	105
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.			

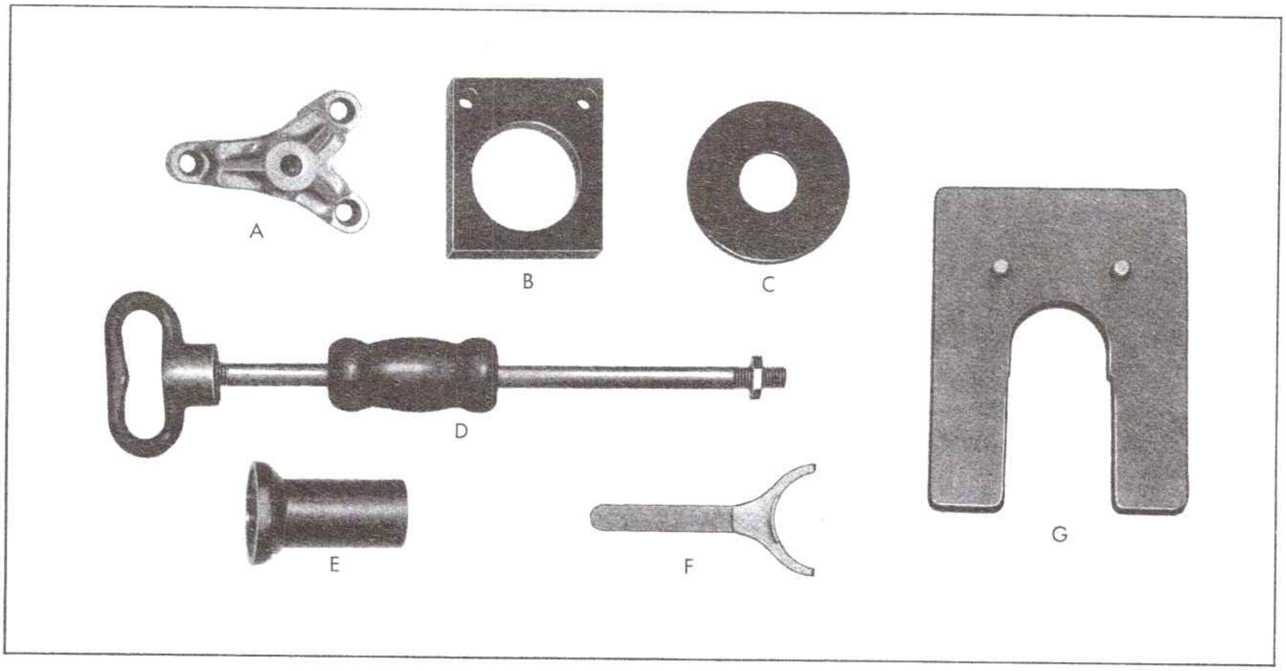


Fig. 4-35 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8131	Rear Axle Shaft Puller	E	J-21011	Rear Wheel Bearing Oil Seal Installer
B	J-2986-3	Rear Wheel Bearing Holding Tool	F	J-21010	Rear Wheel Bearing Oil Seal Remover
C	J-6257	Rear Wheel Bearing Installer	G	J-2986-1	Rear Wheel Bearing Plate and Pin Assembly
D	J-2619	Slide Hammer			

REAR AXLE

GENERAL DESCRIPTION

NOTE: The following information pertains only to the Fleetwood Eldorado.

The rear axle used on 693 series cars is a welded assembly of the beam type with a drop center. This configuration allowed the spare tire to be stowed directly behind the rear seat. The rear wheel spindles are a press fit and bolted to the rear axle assembly.

Tapered roller bearings are used in the rear wheels. The rear wheel bearings do not require regularly scheduled repacking. When major brake service is being performed, however, it is recommended that the rear wheel bearings be cleaned and repacked with a high melting point grade 2 Lithium grease.

SERVICE INFORMATION

NOTE: The service information that follows pertains to only the Fleetwood Eldorado. For service procedures not given, refer to the forward portion of the appropriate subsection as these procedures are the same as for the other 1967 Cadillac models.

38. Rear Wheel Bearing Adjustment

Regularly scheduled rear wheel bearing repacking is not required. When major brake service is being performed, however, it is recommended that the rear wheel bearings be cleaned and repacked with a high melting point grade 2 Lithium grease.

Adjustment of the rear wheel bearings should be made while revolving the wheel at least three times the speed of nut rotation when taking the torque readings.

1. Check to make sure that hub is completely seated on wheel spindle.

2. While rotating wheel assembly, tighten spindle nut to 30 foot-pounds using a 0-50 foot-pound torque wrench. Make certain all parts are properly seated and that threads are free.

3. Back off spindle nut one quarter turn (90°), and install cotter pin.

NOTE: If cotter pin cannot be installed in either of the two available holes in the spindle with nut in the above position, loosen spindle nut until cotter pin can be installed.

4. Peen end of cotter pin over sufficiently against side of nut. Cotter pin must be tight after installation, if it can be moved with finger, vibration may cause it to wear and break.

39. Rear Hub

a. Removal

1. Raise rear of car and remove rear wheel.

2. Remove rear brake drum.

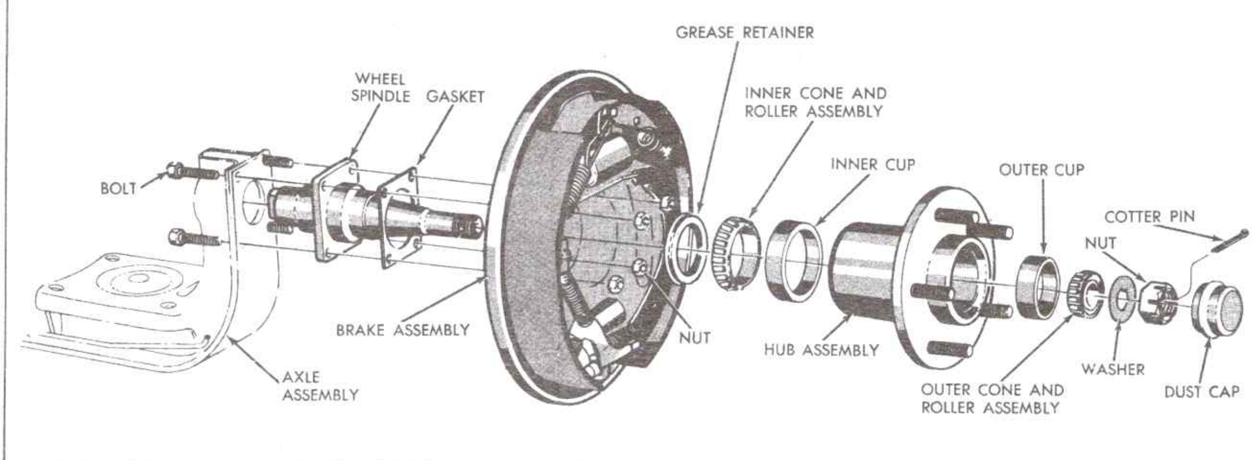


Fig. 4-36 Rear Wheel Disassembled - 693

3. Remove dust cap, cotter pin, spindle nut, washer and outer cone and roller assembly, Fig. 4-36.

4. Carefully pull hub off of spindle.

b. Installation

1. Install rear hub on spindle, after wiping any accumulated grease from spindle, leaving only a light film.

2. Install outer cone and roller assembly and washer over spindle into hub, and install spindle nut finger-tight.

3. Install rear brake drum and wheel.

4. Adjust rear wheel bearing as described in Note 38.

5. Check and, if necessary, adjust rear service brakes.

6. Install dust cap and wheel disc and lower car.

40. Rear Wheel Bearings and Grease Retainer (Fig. 4-36)

a. Removal

1. Remove hub assembly as described in Note 39a.

2. Pry grease retainer from inner side of hub.

NOTE: The inner bearing grease retainer tool, Section 10, Note 3b, may be used to remove the grease retainer.

3. Remove inner cone and roller assembly from hub.

4. Inner and outer bearing cups are press fitted in hub, and can be removed, if necessary, by driving out from opposite side with a brass drift.

b. Inspection

1. Thoroughly clean all parts in clean solvent.

2. Check bearings for cracked separators and worn or pitted rollers.

3. Check bearing races for cracks, scores or a brinelled condition.

NOTE: Discolored stripes on bearing races of new cars do not necessarily indicate a rough bearing race.

c. Installation

1. If inner bearing cup was removed, drive or press cup, small I.D. side first, into inner side of hub using Universal Handle, J-8092, and Inner Bearing Cup Installer, J-8458.

2. If outer bearing cup was removed, drive or press cup, small I.D. side first, into outer side of hub using Universal Handle, J-8092, and Outer Bearing Cup Installer, J-8849.

3. Pack bearing cage with high melting point grade 2 Lithium grease. Use a commercial bearing packer or pack bearings by hand, forcing grease in at large end of cage until it protrudes from the small end.

4. Install inner cone and roller assembly into inner side of hub.

5. Drive or press new grease retainer into inner side of hub using Universal Handle, J-8092, and Grease Retainer Installer, J-8456.

6. Wipe spindle clean and apply a thin film of wheel bearing grease to spindle.

7. Install rear hub as described in Note 39b.

41. Rear Wheel Spindle (On-Car)

a. Removal

1. Raise rear of car and place on jack stands at rear frame pads.

2. Remove rear hub as described in Note 39a.

3. Disconnect service brake line fitting at wheel cylinder.

4. Remove four nuts and bolts securing brake backing plate to spindle.

5. Remove brake backing plate from wheel spindle and place backing plate out of the way.

6. Place jack under rear axle.

7. Remove four nuts from center spring clamp assembly, and lower rear axle until spindle is accessible.

8. Remove lower spring insulator from rear axle.

9. Drive spindle out of rear axle.

b. Installation

1. Start new spindle, with keyway up, into axle and install four backing plate-to-spindle nuts.

2. Progressively tighten nuts until spindle is fully seated and then remove attaching nuts and bolts.

3. Position lower spring insulator on rear axle.

4. Position rear axle to center spring clamp making sure that spring aligning pin locates into axle, lower insulator is properly positioned and that center spring clamp bolts engage rear axle mounting holes.

5. Install four nuts securing rear axle to center spring clamp, tightening to 30 foot-pounds.

6. Install new gasket on wheel spindle.

7. Install brake backing plate on spindle and secure with four attaching nuts, tightening nuts to 40 foot-pounds.

8. Connect brake line fitting to wheel cylinder, tightening fitting to 14 foot-pounds.

9. Install rear hub as described in Note 39b.

42. Rear Axle

a. Removal

1. Raise rear of car, and place on jack stands at rear frame pads ahead of rear wheel opening.

2. Remove rear wheels.

3. Remove rear hub assemblies as described in Note 39a.

4. Disconnect brake lines at wheel cylinders.

5. Disconnect parking brake cable at equalizer.

6. Disconnect rubber brake hose at underbody connector.

7. Disconnect overtravel lever link from bracket on rear axle.

8. Remove spring guides retaining parking brake cable to center spring clamp.

9. Remove four nuts retaining brake backing plates to spindles and remove backing plates, if rear axle is being replaced.

10. Supporting rear axle at center with a hydraulic jack, remove eight nuts, four each side, from center spring clamp assemblies.

11. Lower jack and rear axle and remove rear axle from car.

12. Remove lower spring insulators from rear axle. If rear axle is being replaced proceed as follows:

a. Remove bolt securing brake line junction fitting to axle.

b. Remove four clips securing brake lines to axle, and remove brake line assembly.

c. Remove bolt securing overtravel lever link bracket to axle and remove bracket, if car is so equipped.

d. Drive spindles from axle. Brace axle end being driven to reduce axle movement.

e. Remove rubber bumpers from top of rear axle.

b. Installation

1. If step 12 in removal procedure was performed, proceed as follows:

a. Insert spindles, with keyway up, into rear axle. Using backing plate attaching bolts and nuts, progressively tighten nuts until spindle is fully seated. Remove nuts.

b. Position brake line assembly to rear axle and install bolt securing brake line junction fitting to rear axle.

c. Install four clips securing brake lines to rear axle.

d. Position overtravel lever link bracket to axle and secure with bolt.

e. Install rubber bumpers on top of rear axle.

2. Position lower spring insulators on rear axle.

3. Place rear axle on hydraulic jack and, with the aid of a helper, position rear axle to car. Make certain that center spring clamp bolts engage rear axle mounting holes.

4. Install eight nuts, four each side, securing rear axle to center spring clamp. Tighten to 30 foot-pounds.

5. Remove hydraulic jack.

6. Install new gasket on spindle.

7. Position brake backing plates to spindle and install four nuts and bolts securing backing plates to spindle, tightening to 40 foot-pounds.

8. Connect brake lines to wheel cylinders, tightening to 14 foot-pounds.

9. Install hub assemblies as described in Note 39b.

10. Connect rubber brake hose at underbody connector, tightening fitting to 30 foot-pounds.

11. Install spring guides retaining parking brake cable to center spring clamp.

12. Connect parking brake cable at equalizer, adjusting parking brake as described in Section 5, Note 2.

13. Install overtravel lever link to bracket on axle, if car is equipped with Automatic Level Control.

14. Bleed brakes as described in Section 5, Note 9.

15. Remove jack stands and lower car.

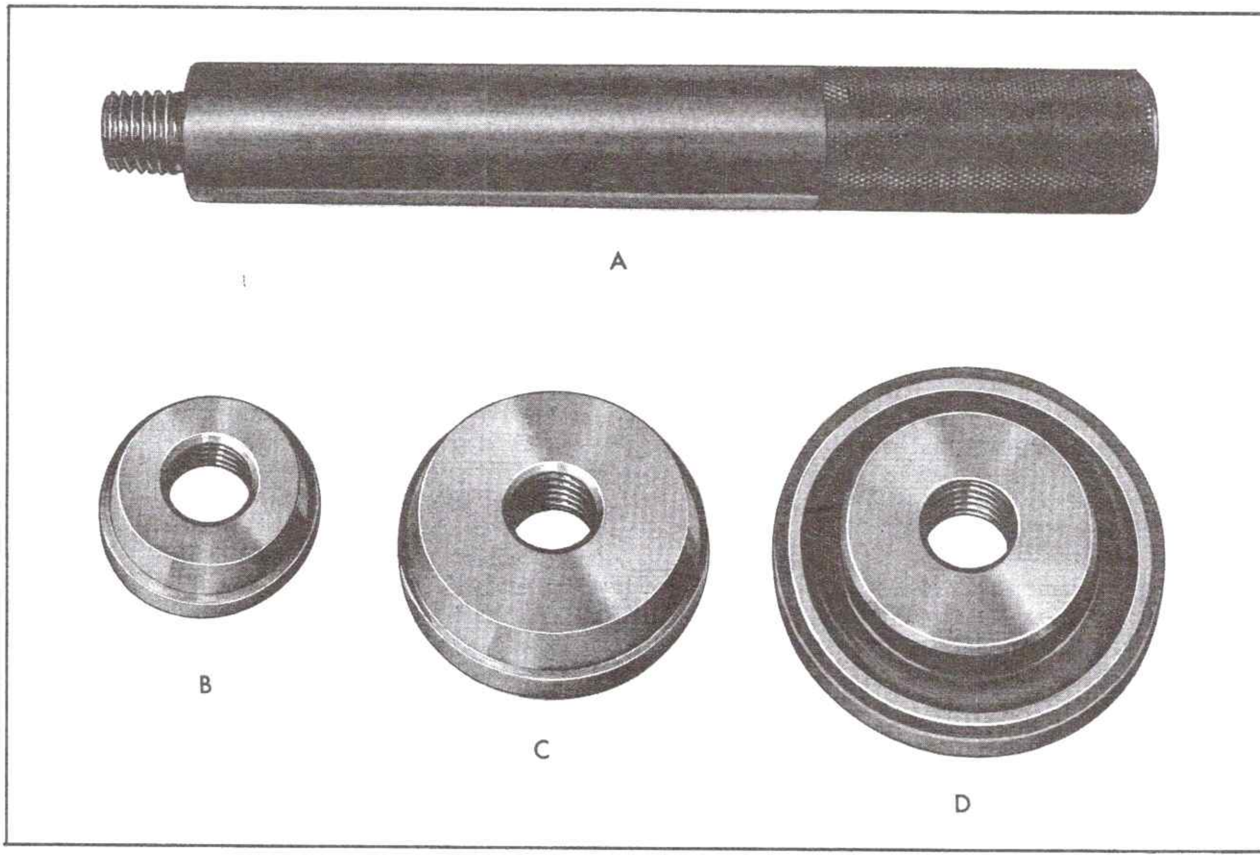


Fig. 4-37 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8092	Universal Handle	C	J-8456	Grease Retainer Installer
B	J-8849	Outer Bearing Cup Installer	D	J-8458	Inner Bearing Cup Installer

DIFFERENTIAL CARRIER

GENERAL DESCRIPTION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

The standard differential carrier and rear axle assembly, Fig. 4-38, is used on all 1967 model conventional-drive Cadillac cars. A Controlled Differential carrier is available as an extra cost option on all 1967 model conventional drive Cadillac cars.

A double lip differential carrier pinion oil seal is used on both type carriers. The seal case is of one piece flangeless construction with a double lip sealing element. The outer lip serves to keep dirt and water from the oil sealing member.

The differential carrier has a flange for attachment of the propeller shaft rear universal joint. Also, it incorporates a bolted-on differential carrier nose bumper arm, except on 698 series cars, that extends over the rear universal joint. The arm limits the axle wind-up by contacting a bumper on the underbody.

Controlled Differential

The basic advantage of the optional Controlled Differential over the standard differential is that the major driving force is always directed to the wheel having the greater traction. The unit is not a positive lock type. It will release before an excessive amount of torque is directed to one rear wheel.

The main purpose of the Controlled Differential is to reduce the possibility of the car getting stuck while driving under slippery conditions. It also minimizes wheel spin and resultant drive line shock when accelerating on an uneven road surface.

During normal driving and cornering, the Controlled Differential unit functions as a standard differential. When one wheel encounters a slippery surface, however, the Controlled Differential allows the wheel with the greater traction to drive the car.

Wheelspin can occur if over-acceleration is attempted. However, the major driving force will still be directed to the other wheel. This condition does not indicate failure of the unit.

When checking the runout of rear wheels on cars equipped with a Controlled Differential, be sure to raise both rear wheels off the ground. Otherwise, the wheel in contact with the ground

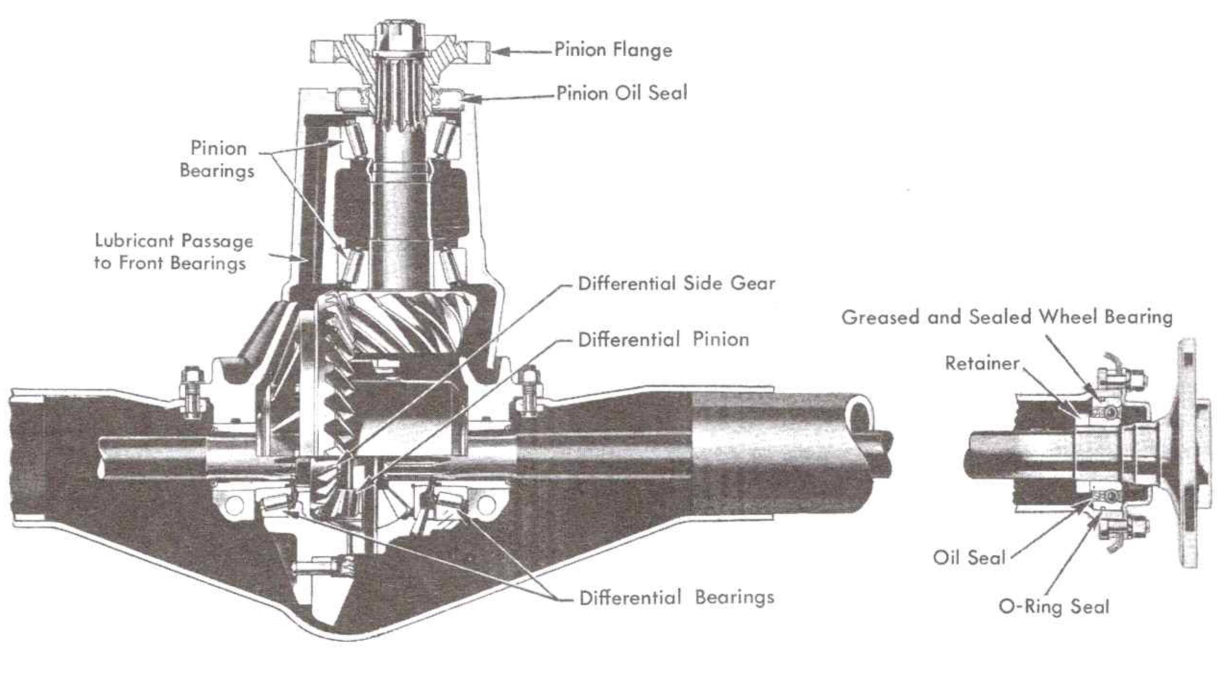


Fig. 4-38 Differential Carrier and Rear Axle Assembly

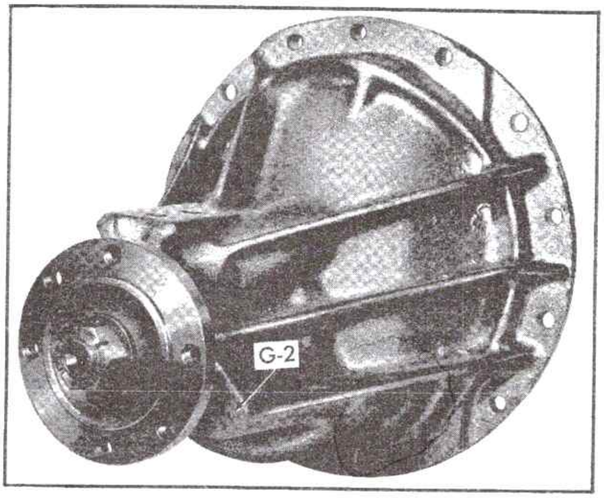


Fig. 4-39 Differential Carrier

will drive when the opposite wheel is raised and rotated.

Use only the special lubricant available from Servicing Parts Warehouses on cars equipped with the Controlled Differential to assure satisfactory operation of this unit.

Use of other types of lubricants, including those that are specified by their manufacturer as "for use in all limited slip differentials", may cause a chatter or other noise . . . even when added to the factory-installed lubricant in small amounts.

All service information in this section applies to the controlled as well as the standard differential carrier assemblies, unless otherwise noted.

All differential carriers are serviced only as assemblies, with the exception of the pinion flange and seal.

Differential Carrier Gear Ratios

The differential carrier gear ratios used on the different series cars provide maximum performance and economy for each series.

The gear ratio of the rear axle assembly on 1967 Cadillac cars can be determined by an identification number stamped on the front face of the carrier assembly at the end of the oil return passage, Fig. 4-39.

In the case of a Controlled Differential, the the letter "G" precedes the differential carrier identification number. For example: "G-2" is a Controlled Differential with a gear ratio of 2.94-1.

The gear ratios and corresponding identification numbers for the various series are as follows:

Series	Ratio	Identification Number*
1967 - 680, 681, 682, and 683 (except cars equipped with Automatic Climate Control	2.94 - 1	2
1967 - 680, 681, 682, and 683 (equipped with Automatic Climate Control) and 697 cars. (Optional on all 680, 681, 682, and 683 cars)	3.21 - 1	1
1967 - 698	3.36 - 1	6
*Letter "G" preceding the identification number indicates a Controlled Differential		

SERVICE INFORMATION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

43. Differential Carrier Pinion Flange and Oil Seal

When replacing the differential carrier pinion flange or oil seal, follow the procedure outlined below. Failure to do so may result in overloaded pinion bearings or drive pinion end play.

a. Removal

1. Place transmission selector lever in park. Raise rear end of car, and remove both rear wheels and brake drums to eliminate drag when measuring torque readings.

2. Remove two attaching screws and lockwashers that secure differential carrier nose bumper arm.

3. Remove propeller shaft as described in Note 28a, or 29a.

4. Using a 0-100 inch-pound torque wrench and a 1-1/4 inch socket with a 3/4 to 1/2 inch adapter, measure the inch-pounds torque required to rotate the pinion shaft slowly for at least two turns, Fig. 4-40. Record torque reading.

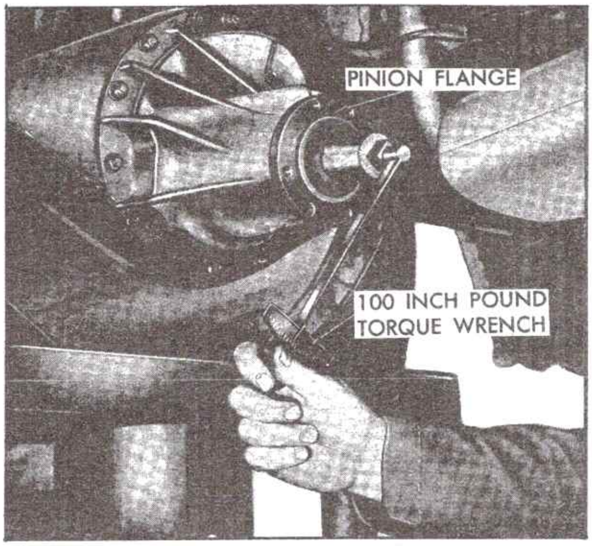


Fig. 4-40 Checking Pinion Shaft Pre-Load Torque

5. Install adapters, J-21044 on pinion flange and install pinion flange holding tool, J-8614-1, with raised side of tool against adapters, and secure with two attaching bolts.

6. Install 1-1/4 inch socket on pinion nut through hole in holding tool and remove nut, using a 3/4 inch drive socket wrench.

7. Remove washer from pinion shaft and mark pinion shaft and flange so that flange can be installed in same position on spline.

8. Install Rear Axle Pinion Flange Puller, J-8614-2, through hole in Holding Tool, index puller 45° and remove pinion flange from pinion shaft, Fig. 4-41.

9. Pry out pinion oil seal.

10. Remove staking burrs on pinion shaft threads with a small file or a 7/8 inch x 14 thread die.

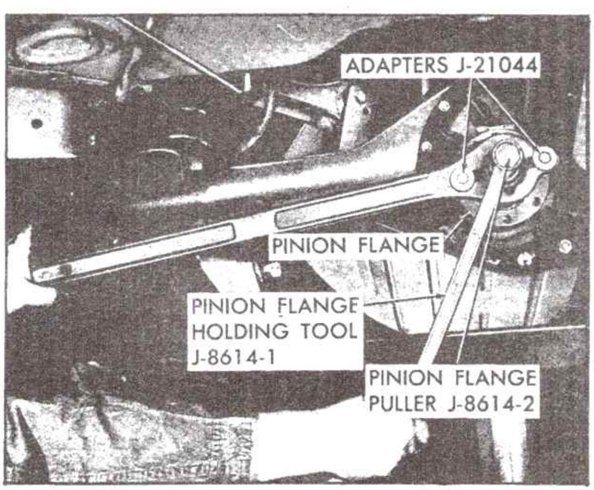


Fig. 4-41 Removing Pinion Flange

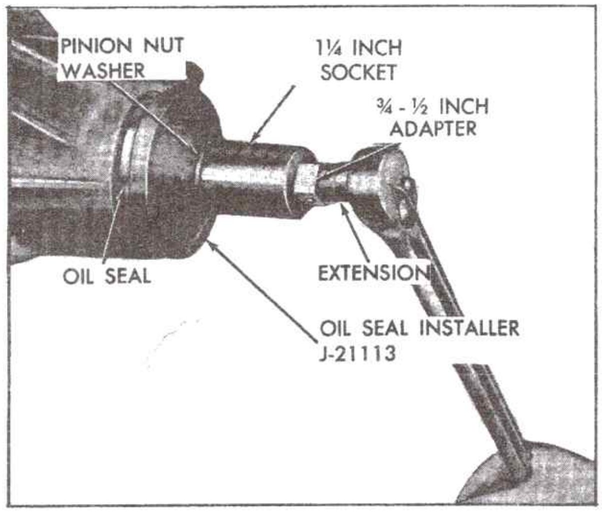


Fig. 4-42 Installing Pinion Oil Seal

b. Installation

CAUTION: Under no circumstances should pinion oil seal be hammered into position. This could result in damage to seal and possible failure of the entire unit.

1. Position oil seal in carrier. Place Oil Seal Installer, J-21113, against seal and secure tool and seal with pinion nut and washer.

2. Using 1-1/4 inch socket, 3/4 to 1/2 inch adapter and extension, press oil seal into carrier by tightening pinion nut, Fig. 4-42, until Installer Tool bottoms on face of carrier. When installed seal case will protrude approximately 3/32 inch from machined face of carrier.

3. Remove pinion nut, washer and Oil Seal Installer, J-21113.

NOTE: Make certain that seal surface of flange is free from scratches or nicks. If necessary, clean with No. 400 grit "wet" paper and kerosene. Use only a circular motion when sanding seal surface of flange so as not to leave any spiraled marks on seal surface.

4. Install flange on pinion shaft splines with alignment marks lined up.

5. Install washer and new pinion nut on pinion shaft.

6. Install Adapters, J-21044, on pinion flange and install Pinion Flange Holding Tool, J-8614-1 on adapters with raised side of tool against adapters. Secure with two attaching bolts.

7. Install socket on pinion nut through hole in Holding Tool and tighten nut using 3/4 inch drive

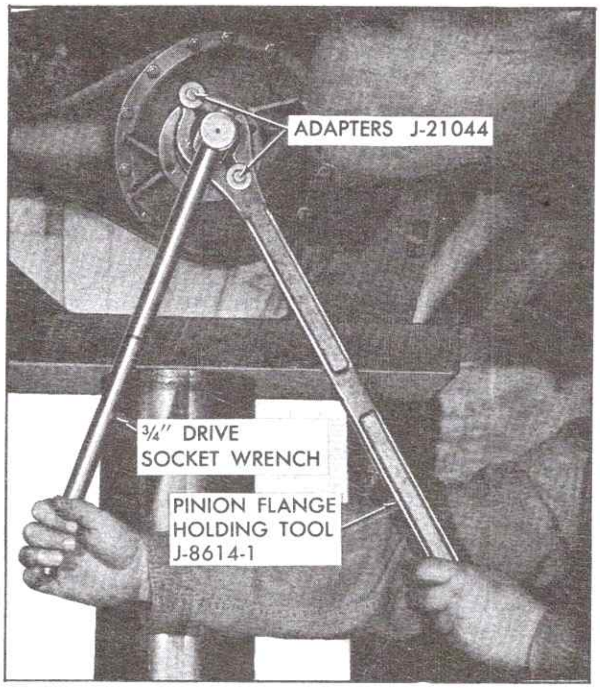


Fig. 4-43 Tightening Pinion Nut

socket wrench, Fig. 4-43, until proper pre-load of bearing is attained.

NOTE: Proper pre-load of bearing is attained when torque required to rotate pinion shaft is from 2 to 5 inch-pounds greater than the torque recorded in step 4 of the removal procedure. It will be necessary to remove Holding Tool and drive socket wrench and to install 3/4 - 1/2 inch adapter to check torque required to rotate pinion shaft, Fig. 4-40.

If torque is low, tighten pinion nut slightly and again measure the inch-pounds torque required to rotate pinion shaft. Repeat this operation tightening the nut slightly each time, until specified torque is obtained. It will require approximately 200 foot-pounds torque on pinion nut to obtain proper bearing pre-load.

CAUTION: Do not overtighten, and never back off on the nut to reduce pre-load torque. The average torque on an assembly with over 1,000 miles is between 15 and 20 inch-pounds. The torque on a new assembly is approximately 50 inch-pounds.

8. Remove Holding Tool Adapters, J-21044, from flange.

9. Stake pinion shaft into nut.

10. Install propeller shaft as described in Note 28b or 29b.

11. Install two attaching screws and lockwashers that secure differential carrier nose bumper arm.

12. Refill rear axle to correct level as described in Section 0, Note 11. Use only the special lubricant available from Servicing Parts Warehouses for cars equipped with a Controlled Differential.

13. Reinstall brake drums and rear wheels, and lower car.

44. Checking Differential Carrier Pinion Flange Run-Out

1. Position car on hoist so that rear wheels will be free to rotate when car is raised.

2. Raise car on hoist and remove propeller shaft assembly as described in Note 28a or 29a.

3. Using a wire brush, thoroughly clean differential carrier pinion flange.

NOTE: Heavy scale may have to be scraped off with carbon scraper. Inspect flange for damage or burrs. Clean propeller shaft rear flange pilot also, to ease reinstallation later.

4. Clamp Dial Indicator Set, J-8001, on noise bumper arm and position dial indicator stem to face of differential carrier between mounting bolt holes and pilot diameter, Fig. 4-44.

5. Rotate pinion flange by rotating rear wheel and note maximum face run-out indicated by dial indicator. Record reading.

6. Attach Dial Indicator Extension, J-7057, to dial indicator. Position extension against side of pilot diameter of the differential carrier pinion flange, Fig. 4-44.

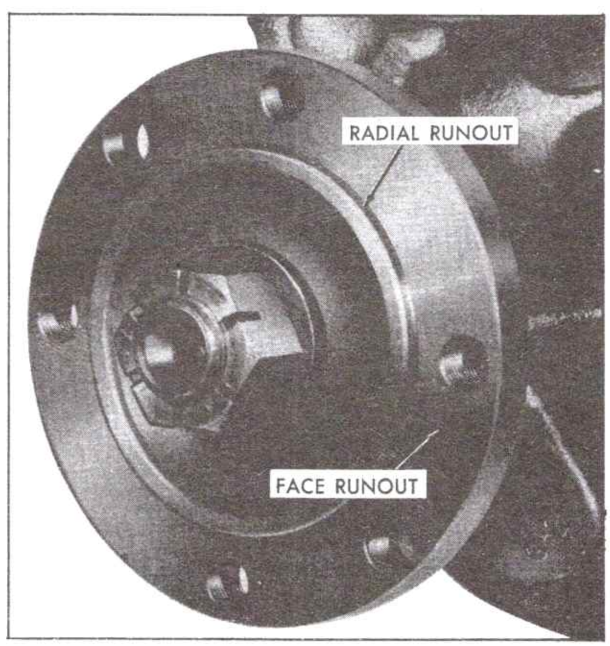


Fig. 4-44 Checking Pinion Flange Run-Out

7. Repeat step 5, noting and recording maximum radial run-out.

8. If combined face and radial run-out exceeds .004 inch, remove and re-index pinion flange on the pinion shaft splines. Follow procedure described in Note 43.

NOTE: Do not perform step 4, Note 43b.

9. Repeat steps 4 - 7. If combined face and radial runout still exceeds .004 inch, replace pinion flange, as described in Note 43a.

10. Install propeller shaft assembly as described in Note 28b or 29b.

45. Differential Carrier

NOTE: Any service on the differential carrier assembly, standard or controlled type, except pinion oil seal and flange replacement, Note 43, should be handled by replacement of the complete assembly. No disassembly or adjustment of these units should be attempted in the field, as special equipment is needed for selection of mating parts and setting side bearing pre-load.

a. Removal

1. Remove propeller shaft as described in Note 28a or 29a.

2. Remove axle shafts as described in Note 37.

3. Remove nuts and washers that hold carrier to axle housing, and remove entire assembly with gasket. Provide container for collecting oil as differential carrier is removed from axle housing.

NOTE: Whenever a carrier is removed because of scored gears, worn bearings, or any failure that might cause dirt or metal chips, clean inside of axle housing with a cleaning solvent soaked cloth, using a rod or stick to reach into tube sections of axle housing. Repeat wiping procedure with a dry cloth. Also check axle shaft assemblies and clean as necessary.

b. Installation

NOTE: On cars equipped with a Controlled Differential, check internal splines of differential side gears and cone clutches to be sure they are aligned. This check is made by inserting axle shaft splines in each side of differential until they bottom against differential pinion shaft (approximately 4 inches).

1. Scrape any old gasket material from housing. Coat both sides of a new gasket with non-hardening sealer and place gasket on housing.

2. Position differential carrier on axle housing and install new copper washers and nuts on housing studs. Torque nuts to 40 foot-pounds.

3. Install axle shafts as described in Note 37.

4. Fill rear axle with lubricant as described in Section 0, Note 11. If a replacement differential is installed, the special differential lubricant shipped with the new differential must be used.

5. Install propeller shaft as described in Note 28b or 29b.

46. Lubricant Leaks

1. Carefully inspect differential carrier and determine location of leak.

a. If leak appears to be between differential carrier and axle housing mounting flanges, proceed to step 2.

b. If leak occurs at one of the differential carrier-to-axle housing nuts, proceed to step 4.

2. Check to make certain that nuts are tightened to 40 foot-pounds.

3. If leak continues, install an extra gasket, using a non-hardening sealer.

4. Remove nut and washer and inspect casting. If there are nicks, grinding marks or roughness, proceed to step 6.

5. If casting finish is unblemished, install new copper washer and tighten nut to 40 foot-pounds.

6. Install a 3/8-24 serrated flanged nut, Part No. 1486645, and torque to 40 foot-pounds.

7. Loosen nut and repeat torque operation ten times to mill face smooth.

8. Remove serrated flanged nut, and install a new copper washer and a new serrated flanged nut, tightening to 40 foot-pounds.

SPECIFICATIONS

Item	All Styles Unless Otherwise Noted
Pinion Flange Face Run-Out and Radial Run-Out (Combined)	.004" Maximum
Gear Ratio	
680, 681, 682 and 683 (except cars equipped with Automatic Climate Control . . .	2.94 - 1
680, 681, 682 and 683 (equipped with Automatic Climate Control and 697. (Optional on all 680, 681, 682 and 683)	3.21 - 1
698	3.36 - 1

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
286-M	Differential Carrier to Axle Housing Nuts	3/8-24	40
286-M	Pinion Shaft Nut	7/8-14	Note 43b Step 7
300-M	Differential Carrier Nose Bumper Arm .	7/16-14	50
300-M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16-20	65

NOTE: Refer to back of Manual, Page 16-1 for bolt and nut markings, and steel classifications.

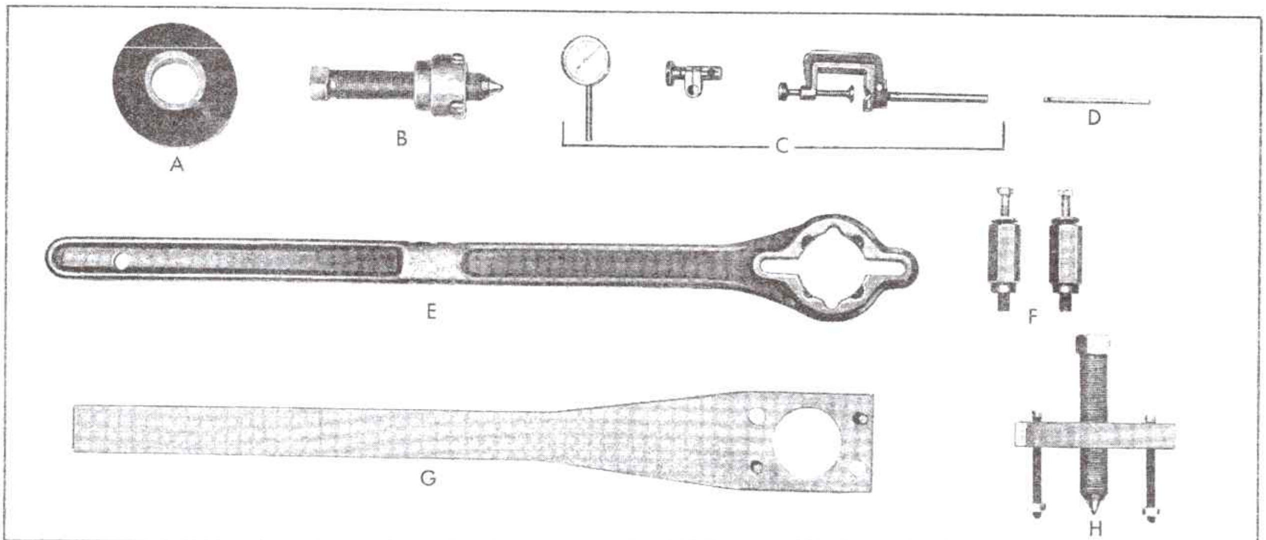


Fig. 4-45 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21113	Pinion Oil Seal Installer	E	J-8614-1	Pinion Flange Holding Tool
B	J-8614-2	Rear Axle Pinion Flange Puller	F	J-21044	Adapter (2 required)
			G	J-6544	Pinion Yoke Holding Tool
C	J-8001	Dial Indicator Set	H	J-6295-01	Rear Axle Pinion Yoke Puller
D	J-7057	Dial Indicator Extension			

GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado brake system, refer to the latter portion of this section.

The braking system used on 1967 Cadillac cars consists of power-assisted, hydraulically-operated front and rear service brakes and a foot-operated, vacuum-released parking brake that applies the brake shoes at the rear wheels through mechanical linkage.

Two makes of power brake units are used in 1967 production: Bendix and Delco Moraine. These units are similar in outward appearance and operation but vary considerably in internal construction. For identification the Bendix unit is painted all black, while the vacuum cylinder of the Delco Moraine unit is zinc plated. The power brake units are composed of two main sections: a vacuum power section and a split system type hydraulic master cylinder.

The vacuum power section of both the Bendix and Delco Moraine units, Fig. 5-1 and 5-2, are of the vacuum suspended diaphragm-type, utilizing engine intake manifold vacuum and atmospheric pressure to provide power-assisted application of the hydraulic service brakes. They consist of a front and rear shell, a power piston assembly that houses the control valve assembly and reaction mechanism, a vacuum power diaphragm, and a power piston return spring. The control valve assembly consists of a single poppet with a filtered atmospheric port and a vacuum port.

The reaction mechanism, integral with the power piston assembly, controls the degree of power brake application or release in accordance with pressure applied to the valve operating rod through the brake pedal linkage. The reaction mechanism in the Bendix unit consists of a rubber disc, whereas a reaction plate and levers are used in the Delco Moraine unit.

The 1967 hydraulic unit is completely sealed from the atmosphere by the use of rubber seals in the master cylinder reservoir. The seals are of the diaphragm type with atmospheric pressure acting on one side of the seal, and the reservoir fluid pressure on the other side. This arrangement permits the seal to follow the level of the brake fluid and prevents moisture absorption or dust contamination.

The master cylinders of both power units are designed so that the front and rear service brakes have separate hydraulic systems. The front section of the master cylinder provides fluid for the

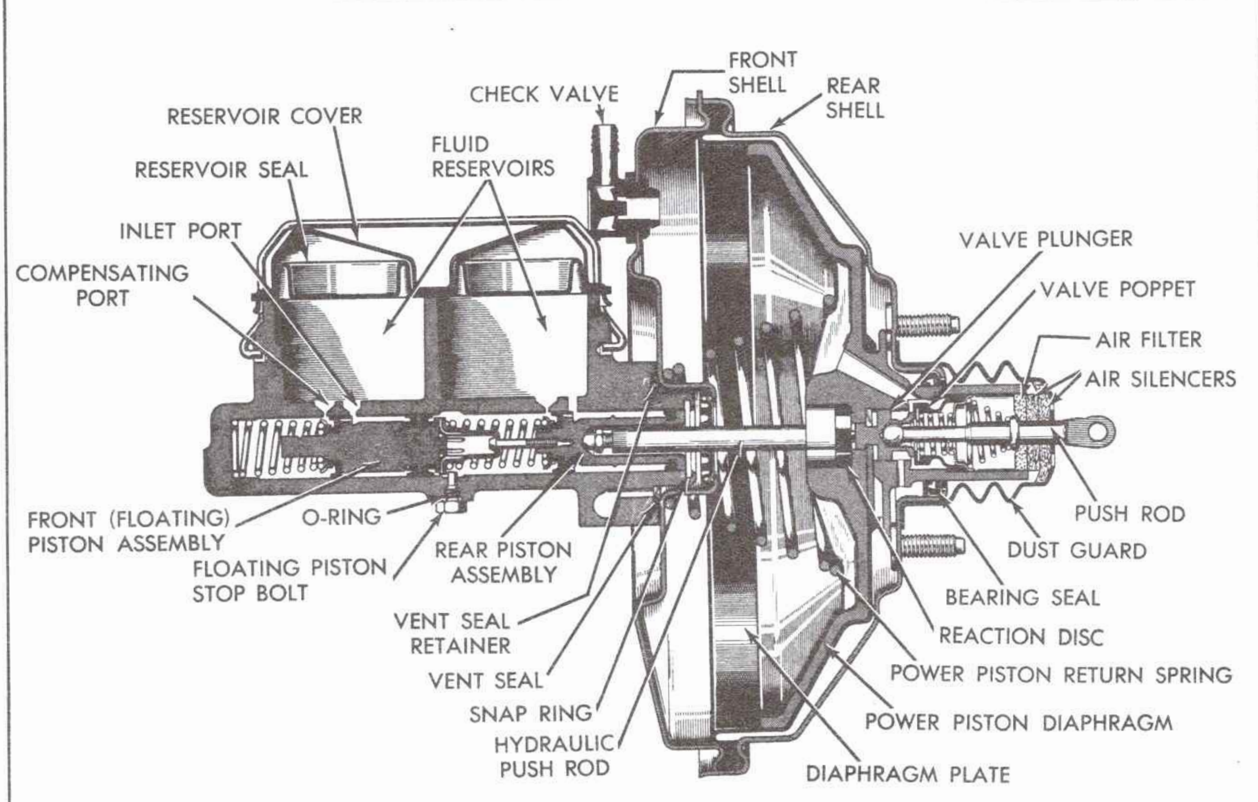


Fig. 5-1 Bendix Power Brake Unit

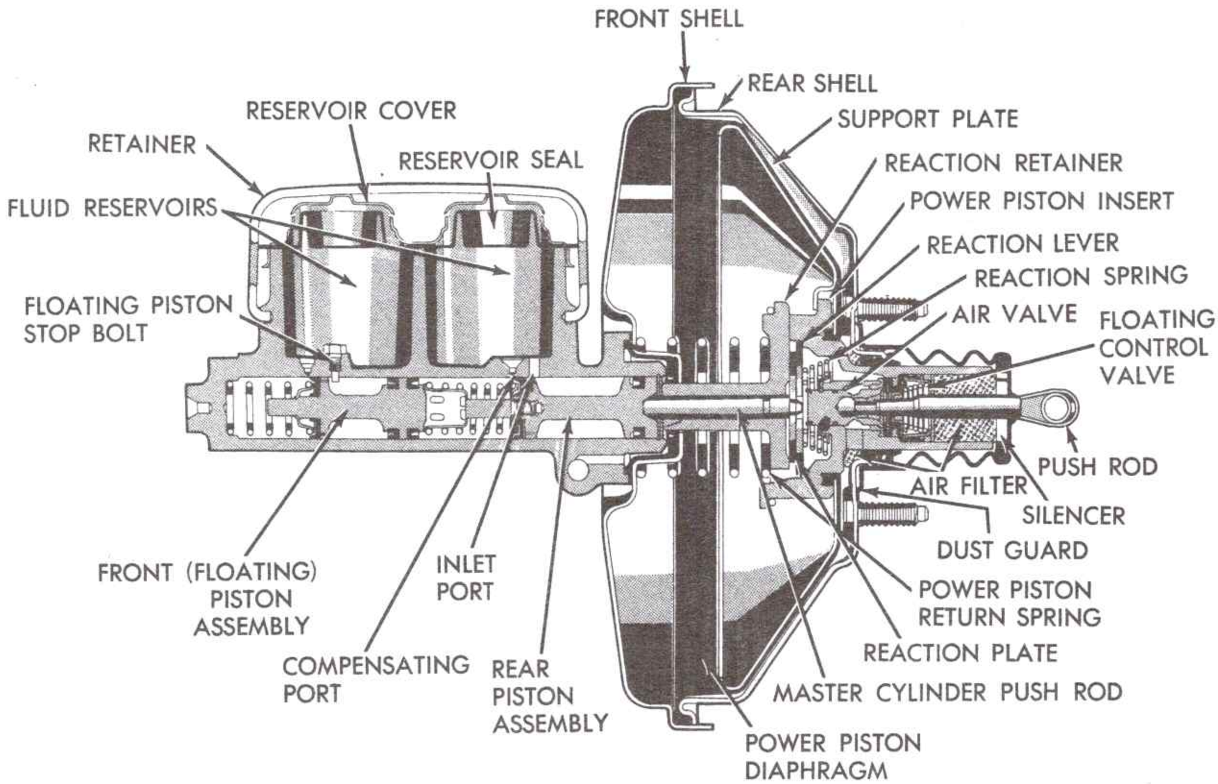


Fig. 5-2 Delco Moraine Power Brake Unit

front brakes, while the rear section provides fluid for the rear brakes. Should a leak occur in the front hydraulic system, the rear brake system will still function. Likewise, if the rear hydraulic system should develop a leak, then the front system would still function. Increased brake pedal travel and an instrument panel brake light warns the driver that such a condition may have occurred.

The BRAKE light, located in the bank of tell-tale lights on the left side of the instrument cluster, is actuated by the brake pedal switch, which also serves as the cruise control switch on cars so equipped, when pedal travel exceeds 2-3/4 inches. This light is also energized during engine cranking for bulb and circuit checking purposes.

A vacuum check valve at the inlet to the power unit permits several applications of the brakes with vacuum assist after the engine has stopped or after any other loss of vacuum supply. When the vacuum stored in the unit is completely used, or in case of vacuum failure at the unit, the brakes can be applied in the conventional manner, but more effort is required due to the loss of power assist.

The wheel cylinders are of the double-piston type. The pistons are made of lubricant impregnated sintered iron to resist corrosion and sticking. A metal expander is used in each piston cup to prevent brake fluid leakage and reduce the possibility of air entering the system during expansion and contraction of the fluid.

The service brakes have self-adjusting brake shoe mechanisms that assure correct lining-to-drum clearances at all times. The automatic adjusters operate only when the secondary brake shoes leave their anchors. This occurs each time the brakes are applied as the car is moving rearward, or after an uphill stop.

The non-adjustable anchor on each brake assembly is stationary and precision-located for efficient braking.

The star wheel adjuster assemblies incorporate spring steel thrust washers between the adjusting screw and the adjuster end cap. These washers provide a spring-cushioned contact between the primary and secondary brake shoes, thus absorbing vibrations that may cause squeak when the brakes are applied. Brake shoe stabilizer plates are used on the front wheel brake assemblies to provide additional squeak control.

The brake linings are riveted to the shoes. The primary linings are grooved at the center to

permit dissipation of heat from the surface of the brake drum, resulting in better brake performance and longer lining life.

Finned, cast iron brake drums with extended flanges are used on both the front and rear wheels to provide maximum brake cooling.

The parking brake assembly is mounted on the cowl to the left of the service brake pedal. The parking brake will release automatically when the transmission selector lever is moved into any drive position with the engine running. It will not release automatically, however, with the engine running and the selector lever in Neutral or Park, or in any position with the engine off. A manual release lever, located on the inboard side of the parking brake assembly, may be used if the automatic release is inoperative or if manual release is desired at any time.

The parking brake automatic release mechanism is operated by a vacuum cylinder assembly. When the transmission selector lever is moved into any drive position with the engine running, a vacuum valve in the neutral safety switch opens, evacuating air from the diaphragm assembly, which in turn disengages the locking mechanism, permitting the parking brake pedal to return to its released position by spring action.

The brake stoplight switch is mounted on a flange on the brake pedal support bracket below the instrument panel. When the brake pedal is depressed, the spring loaded switch plunger follows the brake pedal arm downward until the switch is in the "on" position. When the brakes are released, the arm returns the switch plunger to the "off" position.

It is recommended that Delco Supreme II Super Heavy Duty Brake Fluid, or its equivalent, be used in 1967 Cadillac brake systems.

Brake Fluid should always be stored in closed containers, as it will absorb moisture from the atmosphere. Moisture contamination of brake fluid causes the boiling point of the fluid to be lowered.

SERVICE INFORMATION

NOTE: For service information pertaining to the Fleetwood Eldorado, refer to the latter portion of this section.

1. Manual Brake Shoe Adjustment

Although the hydraulic service brakes are self-adjusting, a preliminary star wheel adjustment is necessary after the brake shoes have been relined or replaced, or when the length of the star wheel adjuster has been changed during some other service operation. Final adjustment is made automatically by adjusters that function when the car is moving backward.

1. Check fluid level in both master cylinder reservoirs. Fluid level should be approximately 1/4 inch below top of reservoir. Add fluid if necessary.

2. Check front wheel bearing adjustment and correct if necessary. See Section 10, Note 3.

3. Check to make certain that parking brake cable and linkage, including levers on rear secondary shoes, are free.

4. Tighten star wheel until brake drum can just be rotated forward with a two-foot bar placed between the studs.

5. Disengage adjuster pawl from star wheel with a hooked tool and back off star wheel 40 notches with a screwdriver or brake adjuster tool, Fig. 5-3.

6. Install wheels and lower car.

7. Drive car alternately forward and backward, applying brakes moderately in each direction until pedal travel does not exceed 1-1/2 inch on a moderate (approximately 30 pound) brake pedal application.

NOTE: On cars with less than 500 miles, pedal travel should not exceed 1-3/4".

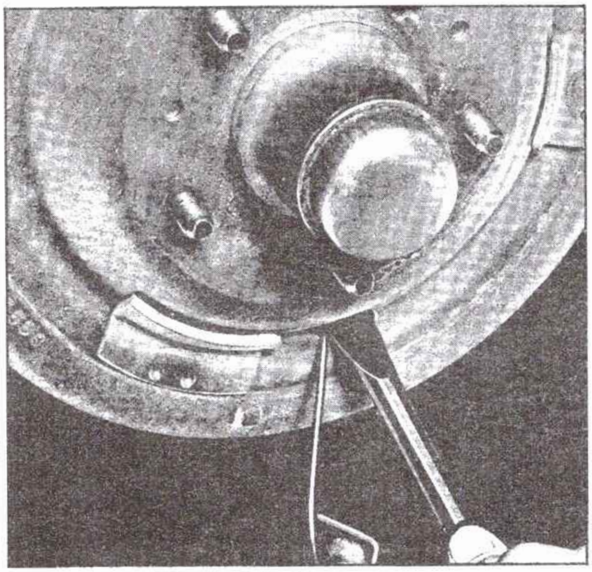


Fig. 5-3 Manual Brake Shoe Adjustment

2. Parking Brake Adjustment

NOTE: Make sure that service brakes are properly adjusted before adjusting parking brake.

1. Lubricate parking brake linkage at equalizer and cable stud, and check for free movement of all cables.

2. Depress parking brake pedal approximately 1-3/4 inches from fully released position, measuring with a ruler.

3. Raise rear wheels off floor.

4. Hold brake cable stud from turning, and tighten equalizer nut, Fig. 5-4, until light drag is felt on either wheel (going forward). After each turn of equalizer nut, check to see if either wheel begins to drag.

5. Release parking brake. No brake shoe drag should be felt at either rear wheel. Operate several times to check adjustment.

NOTE: After adjustment is performed, parking brake pedal should travel 1-3/4 inches to 2-3/4 inches with approximately 50 pounds force on pedal.

6. Lower rear wheels.

3. Brake Shoe Assemblies

When brake relining is necessary, it is recommended that the complete brake lining and shoe assemblies be replaced with new assemblies. New lining and shoe assemblies are precision-ground to fit a twelve-inch drum diameter, minimizing the possibility of imperfect braking action due to warped brake shoes or partial contact between linings and drum. This simplifies the complete relining operation and insures a satisfactory job for the customer.

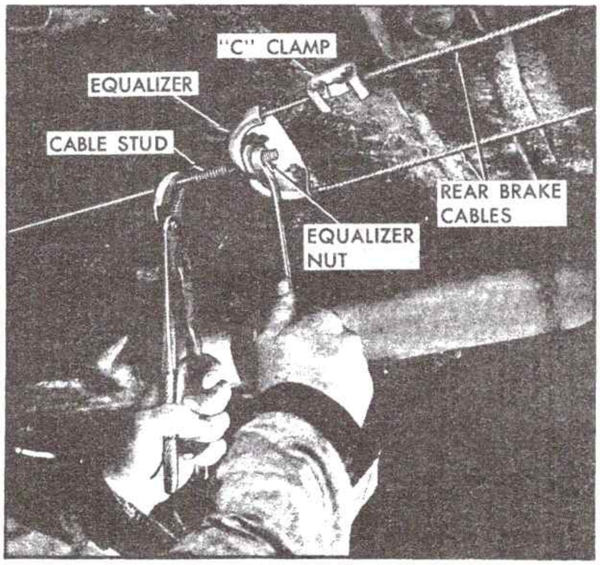


Fig. 5-4 Parking Brake Adjustment

Those Service Departments that have adequate brake shoe relining equipment may obtain linings, drilled and cut to size, from their servicing Parts Warehouses. Brake lining grinding equipment should incorporate brake shoe holders that locate the shoes accurately in relation to the anchor end, as brake anchors are not adjustable and require accurately ground linings.

4. Relining Brakes

a. Front Brakes

1. Raise car and remove front wheels.

2. Remove front brake drum assemblies.

CAUTION: When handling brake drums, be extremely careful not to drop the drum, or get any dirt in front wheel bearings.

3. Remove primary and secondary brake shoe retracting springs, using Brake Spring Remover and Installer, J-8049.

4. Remove primary brake shoe hold-down cup, spring, and pin, and secondary brake shoe hold-down cup, spring, pin, and sleeve.

5. Remove pawl return spring, actuating lever, pawl, and link.

6. Disengage brake shoes from wheel cylinder connecting links and remove complete shoe and lining assembly from brake backing plate.

7. Remove star wheel adjuster and primary-to-secondary connecting spring from shoe assembly.

8. Remove cups, springs, and pins from stabilizer plates and remove plates.

9. Clean brake backing plate and all brake parts.

CAUTION: To avoid the possibility of brake "grab" or "pull" after brake service has been performed, make certain that hands are clean when handling brake parts and avoid handling friction surfaces of drums and linings.

10. Tighten attaching bolts that hold front backing plate to steering knuckle to 65 foot-pounds torque.

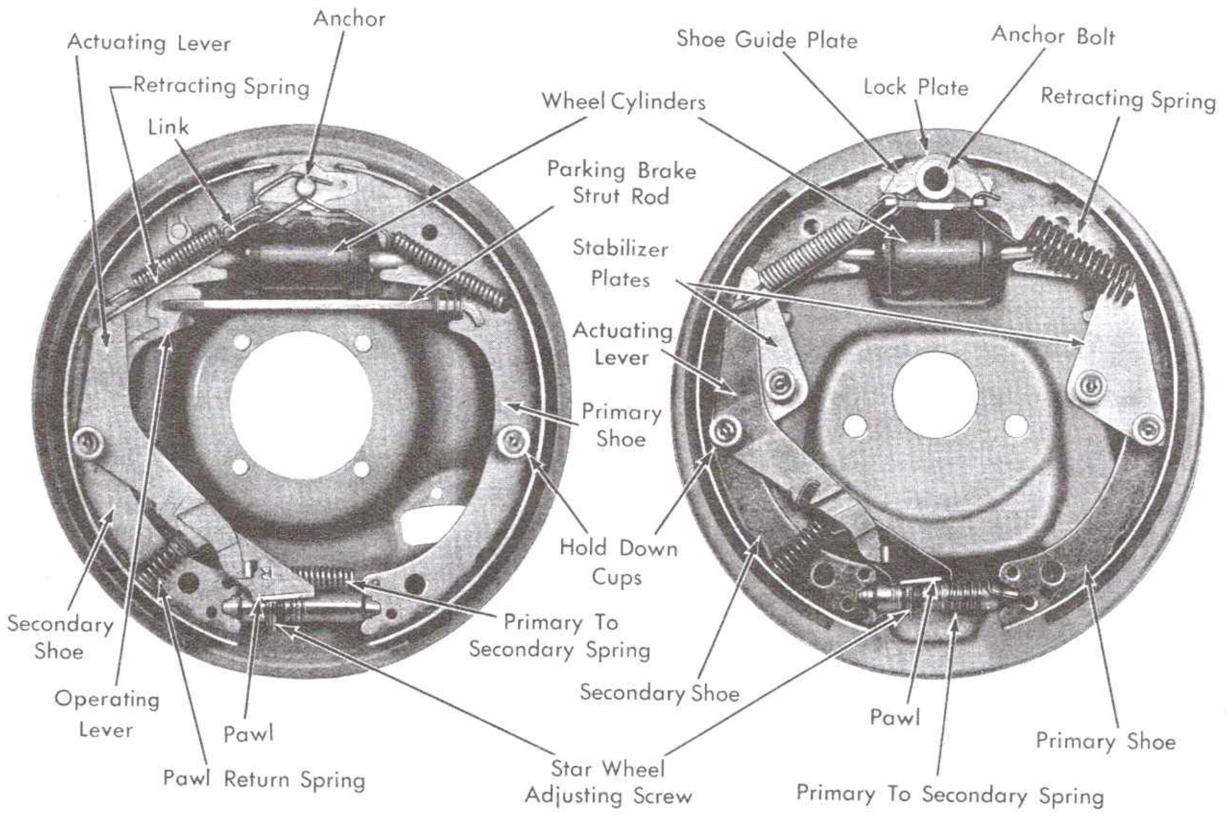


Fig. 5-5 Front and Rear Wheel Brake Mechanisms (Right)

11. Lubricate threads and socket of star wheel adjuster and points of contact between brake shoe and other brake parts with special heat resistant lubricant, available from servicing Parts Warehouses. Use sparingly, especially on brake shoe pads.

12. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

13. Install star wheel adjuster and primary-to-secondary connecting spring on replacement brake shoes.

NOTE: Black spring is used on right side of car and yellow spring on left side. These springs are not interchangeable.

Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand threads) are installed on right side of car and those with three narrow grooves on O.D. pivot nut (right hand threads) must be installed on left side. Incorrect installation of star wheel adjusters would result in automatic adjusters loosening rather than tightening brakes. Be sure small diameter thin thrust washer, Fig. 5-6, is installed between end socket and large diameter spring steel washer in adjuster assembly.

14. Position shoe assembly on brake backing plate so that shoes engage wheel cylinder connecting links.

15. Position primary stabilizer plate over primary brake shoe and install hold-down pins, cups and springs. Install maroon spring on primary shoe first, for easier installation.

NOTE: A maroon spring is used at the middle of the primary shoe and a yellow spring at the center of the primary stabilizer plate. A blue spring is used on the secondary shoe and a yellow spring at the center of the secondary stabilizer plate.

16. Position secondary stabilizer plate over secondary brake shoe, then position actuating lever and pawl so that actuating lever is on top of secondary stabilizer plate. Secure with hold-down pin, sleeve, spring and cup.

17. Install hold-down pin, cups, and spring at center of stabilizer plates.

18. Install pawl return spring and link. Make certain that star wheel engages pawl.

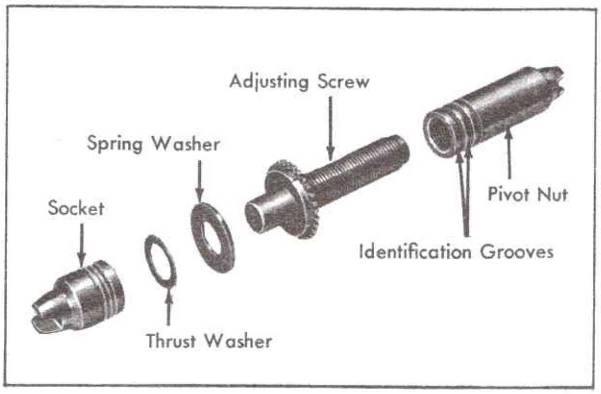


Fig. 5-6 Star Wheel Adjuster Disassembled

19. Install black primary and yellow secondary brake shoe retracting springs, using Brake Spring Remover and Installer, J-8049.

20. Wipe steering knuckle clean and apply a thin film of wheel bearing grease on spindle.

21. Install front brake drums and adjust wheel bearings as described in Section 10, Note 3.

CAUTION: Do not let any grease or oil get on drums or linings.

22. Perform preliminary service brake adjustment as described in Note 1.

23. Install wheels on brake drums. Tighten wheel mounting nuts to 105 foot-pounds.

b. Rear Brakes

1. Release parking brake, raise car, and remove rear wheels.

2. Remove rear brake drum assemblies.

3. Loosen parking brake cable locknut on equalizer.

4. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.

5. Disconnect link at anchor and remove link, secondary brake shoe retracting spring, and anchor plate.

6. Remove primary brake shoe hold-down cup, spring and pin, and secondary brake shoe hold-down pin, cup, spring, and sleeve.

7. Remove pawl return spring, actuating lever, and pawl.

8. Disengage brake shoes from wheel cylinder connecting links and parking brake strut rod. Remove strut rod and spring.

9. Disconnect parking brake cable from operating lever on secondary shoe and remove complete shoe and lining assembly from brake backing plate.

10. Remove star wheel adjuster and primary to secondary connecting spring from shoe assembly.

11. Remove clip from pin on secondary brake shoe and remove operating lever and pin assembly.

12. Clean brake backing plate and all brake parts.

CAUTION: To avoid the possibility of brake "grab" and "pull" after brake service has been performed, make certain that hands are clean when handling brake parts and avoid handling friction surfaces of drums and linings.

13. Tighten nuts that hold backing plate to rear axle housing to 40 foot-pounds.

14. Install operating lever and pin assembly on replacement secondary brake shoe and secure with clip.

15. Lubricate threads and socket of star wheel adjuster and points of contact between brake and other brake parts with a heat resistant lubricant, available from servicing Parts Warehouses. Use sparingly, especially on brake shoe pads.

16. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

17. Install star wheel adjuster and primary-to-secondary connecting spring on brake shoes. Make certain that star wheel rotates in proper direction.

NOTE: Maroon springs are used on both left and right hand rear brake shoe assemblies. These springs are interchangeable.

Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand threads) Fig. 5-6, are installed on right side of car and those with three narrow grooves on O.D. of pivot nut (right hand threads) must be installed on left side.

18. Position shoe assembly on brake backing plate and connect parking brake cable to operating lever.

19. Install parking brake strut rod and spring on brake shoe assembly.

NOTE: Light blue spring is used on left side and white spring on right side. These

springs are not interchangeable. Spring tab must be positioned outside of brake shoe web on both rear brakes.

20. Engage shoes with wheel cylinder connecting links and install hold-down pin, cups, and spring on primary brake shoe.

NOTE: Maroon primary and blue secondary hold-down springs are used on the rear brake assemblies.

21. Position actuating lever and pawl so that actuating lever is on top of secondary brake shoe. Secure with hold-down pin, sleeve, spring, and cup.

22. Install anchor plate, link, and secondary brake shoe retracting spring (yellow). For easiest installation, first connect spring to link, then install link on anchor, using brake Spring Remover and Installer, J-8049.

23. Install pawl return spring. Make certain that star wheel engages pawl.

24. Install primary brake shoe retracting spring (red) using Spring Installer, J-8049.

25. Install rear brake drums on rear axle shaft flange and secure with screw.

26. Perform preliminary service brake adjustment as described in Note 1.

27. Install wheels on brake drums. Tighten wheel mounting nuts to 105 foot-pounds.

28. Adjust parking brake as described in Note 2.

5. Machining Brake Drums

Brake drums should be carefully checked to see if they have become warped or scored excessively. If they appear salvageable and if suitable equipment is available, they can be machined.

Drum machining is a precision operation. Equipment used for this purpose must be capable of maintaining the close limits specified. Be sure to install drum in the machining equipment correctly and to check runout of lathe spindle to insure accuracy of final machining operation. Inside drum diameter must not be machined over 12.060 inches. Should brake drums be machined too thin, the intense heat that develops under severe driving conditions will cause them to distort, crack or warp.

Replacement brake drums supplied by your servicing Parts Warehouses are finish-machined at the factory before being shipped. They do not require any further finishing before installation, but they must be thoroughly cleaned with a non-oil base solvent to remove all traces of the oil or grease used for rust-proofing during storage and transit. Do not machine drums to roughen the braking surface. Use coarse emery cloth for this purpose.

6. Break-In of New Linings

New or replacement brake linings, if subjected to normal usage at speeds under 50 MPH, need no special break-in. However, the first few brake applications may be somewhat erratic, and Servicemen may need to stabilize the brakes before delivering the car to the owner. If brake action is erratic, one acceptable way to seat the brakes is to make five or ten moderate brake stops at speeds of 30 to 40 MPH, at approximately one quarter mile intervals.

Severe break-in is apt to produce small charred flakes on the lining surface which will produce a decided pull. If this should occur, lining surface should be sanded slightly to remove any flakes. Use only common sandpaper for this purpose so that all abrasive particles can be removed with the lining dust by careful use of clean compressed air.

7. Wheel Cylinder Removal, Disassembly and Cleaning

a. Removal

1. Raise car and remove wheel and brake drum. Blow out dust and dirt from drum and linings, being careful not to blow dirt into wheel bearing areas.

2. Disconnect hydraulic brake hose or brake piping from wheel cylinder.

CAUTION: If wheel cylinder is on either front wheel, it is necessary to remove hydraulic brake hose, as described in Note 11a, before disconnecting from wheel cylinder.

3. Remove brake shoe retracting springs and link.

4. Remove two screws holding wheel cylinder to backing plate.

5. Disengage wheel cylinder connecting links from brake shoes and remove wheel cylinders.

CAUTION: Be sure brake fluid does not drip on brake linings.

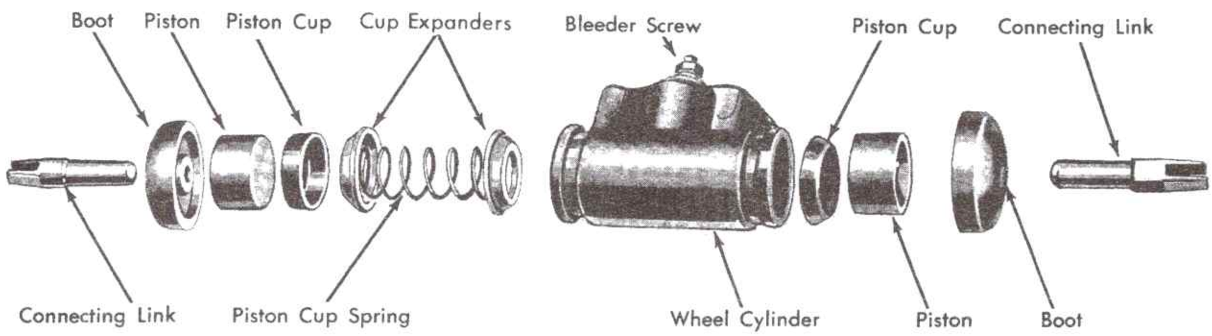


Fig. 5-7 Wheel Cylinder Disassembled

b. Disassembly, Fig. 5-7

1. Remove connecting links and rubber boots from ends of wheel cylinder.

2. Slide pistons and piston cups from either end of cylinder.

3. Remove piston cup spring and expander assembly.

4. Remove bleeder screw assembly.

c. Cleaning

With clean hands, wash all parts except pistons in clean alcohol. Wipe pistons with clean dry cloth. Inspect surface of cylinder bore and hydraulic passages. Replace wheel cylinder if any obstructions are observed in holes or if there are any nicks or burrs in bore.

8. Wheel Cylinder Assembly and Installation

a. Assembly, Fig. 5-7

1. Install bleeder screw assembly.

2. Install piston cup in one end of cylinder with lip toward center, and install piston with flat side toward cup.

3. Place rubber boot over end of wheel cylinder.

4. Install spring and expander assembly.

5. Install other piston cup, lip toward center. Install piston, flat side toward cup.

6. Install remaining rubber boot over end of cylinder.

b. Installation

1. Position wheel cylinder on brake backing plate, slipping cylinder-to-shoe connecting links in place at same time.

2. Install two screws holding wheel cylinder to backing plate. Tighten to 15 foot-pounds.

3. Install brake shoe retracting springs and link.

NOTE: Avoid handling friction surfaces of drums and linings.

4. Install hydraulic brake hose on front wheel as described in Note 11b, or connect brake piping to rear wheel.

5. Install brake drum and wheel assembly.

6. Bleed all brakes as described in Note 9.

7. Lower car.

9. Bleeding Brakes

Bleeding brakes may be made considerably easier through use of one of the pressure brake bleeder tools available. This equipment consists of a tank partially filled with brake fluid and

rubber hose that connects to the hydraulic cylinder reservoir Bleeder Adapter Cover, J-22489-1. Air pressure is applied to the tank to force fluid into the brake system.

The Bleeder Adapter Cover, J-22489-1, seals the brake system from the atmosphere during the bleeding operation, and enables both the Delco Moraine and the Bendix brake systems to be bled with only one hook-up.

After bleeding brakes, check pedal travel as described in Note 1, step 7. Rebleed or adjust brakes as necessary.

CAUTION: Do not spill brake fluid on car finish or damage will result.

a. Pressure Bleeder Method

1. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with fluid.

2. Install Bleeder Adapter Cover, J-22489-1, on master cylinder and connect bleeder hose to Bleeder Adapter Cover.

3. Build up pressure in bleeder.

4. Attach drain hose to bleeder fitting at each wheel.

5. Back off fitting one half turn and bleed brake fluid into a partially filled bottle of clean brake fluid until bubbles stop, then close fitting.

6. Repeat operation for each wheel.

b. Alternate Method

If a pressure bleeder is not available, the following two-man procedure may be used for either unit.

1. Fill both master cylinder reservoirs with brake fluid.

NOTE: Keep reservoirs at least partially filled at all times during bleeding operation.

2. Back off both master cylinder outlet pipe nuts one turn and completely pump brake pedal five times, catching fluid displaced from outlets in a cloth or can. Discard this fluid and retighten outlet pipe nuts. Refill reservoirs.

3. Attach drain hose to fitting at each wheel and suspend loose end of hose into partially filled bottle of clean brake fluid.

4. Apply pressure to brake pedal, back off bleeder fitting one half turn, and depress brake pedal. Close bleeder fitting before releasing pressure on brake pedal. Repeat pedal applications until bubbles stop.

5. Repeat step 4 for each wheel in turn.

10. Stoplight Switch Removal, Installation and Adjustment

a. Removal

1. Disconnect two lead wires from stoplight switch.

2. Remove front locking nut from switch, Fig. 5-8.

3. Remove stoplight switch.

b. Installation

1. Position switch on pedal bracket flange.

2. Install front locking nut, Fig. 5-8.

3. Connect lead wires to switch.

4. Check operation of stoplight.

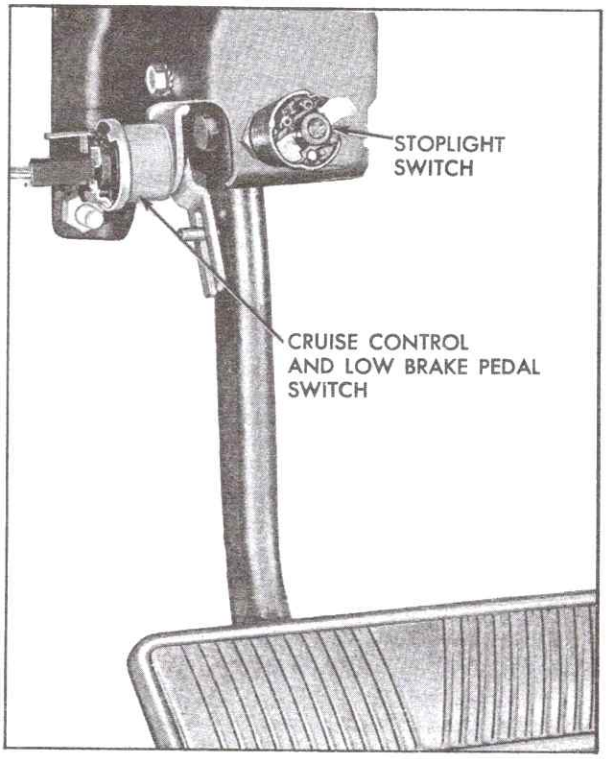


Fig. 5-8 Stoplight Switch Location

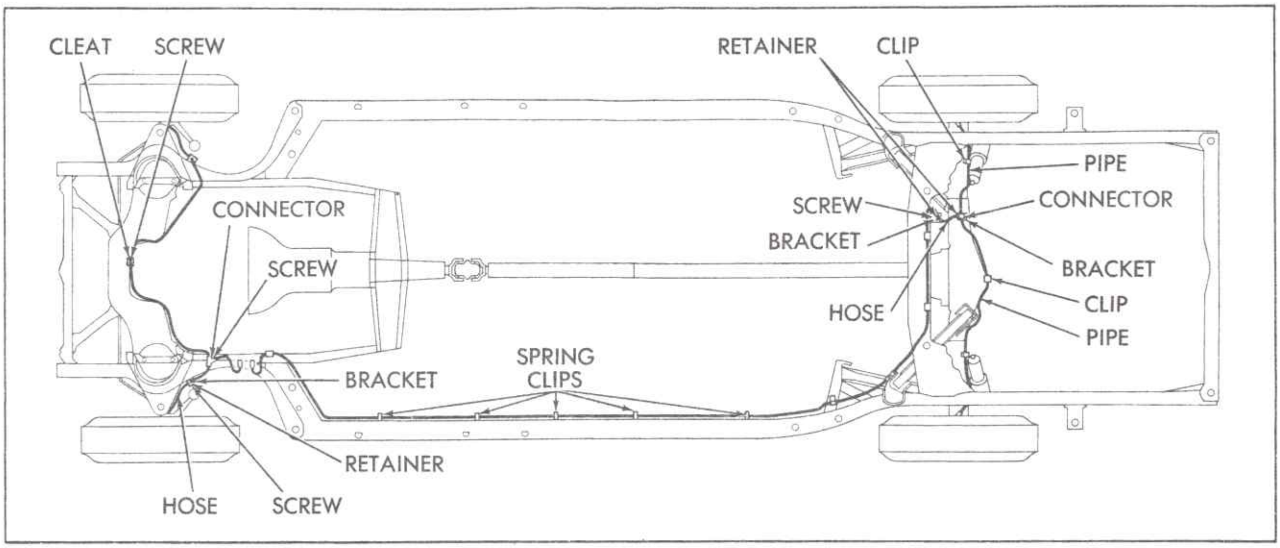


Fig. 5-9 Hydraulic Brake System

c. Adjustment

Adjust switch action so that stoplight is "on" when brake pedal is depressed 1/2 inch. Loosen front and rear nuts that hold stoplight switch and move switch up or down until this action is obtained. Tighten switch locknuts securely to prevent loss of adjustment.

11. Servicing Hydraulic Brake Hoses and Piping

Hydraulic pressure is transferred to the wheel cylinders through steel brake piping, and flexible hoses, Fig. 5-9.

The steel brake lines and flexible hoses should be inspected every spring and fall for damage that may occur from various road hazards.

While the flexible hoses and steel piping require no periodic servicing, it may be necessary to replace damaged hoses or piping in the following manner:

a. Removal—Hydraulic Brake Hose (Front Wheels) Fig. 5-9

1. Disconnect steel brake line from hose by turning steel tube connector nut out of hose fitting. Cap fitting to prevent dirt from entering brake line.

2. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket.

3. Turn hose fitting out of wheel cylinder inlet and remove copper gasket. If hose is to be reinstalled, cover end fittings to prevent dirt from entering hose.

b. Installation—Hydraulic Brake Hoses (Front wheels)

1. Install new copper gasket on cylinder end of hose (male end).

2. Tighten hose in wheel cylinder inlet to 25 foot-pounds.

CAUTION: Never tighten hose in wheel cylinder inlet with hose attached at frame ends as this will twist the hose.

3. With suspension in normal position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in position that will result in least twist in hose.

NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.

4. Install U-shaped retainer to secure hose in frame support bracket.

5. Inspect by turning steering from stop-to-stop while observing hose position. Be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and reinspect.

6. Place steel tube connector nut in hose fitting and tighten to 25 foot-pounds, being careful not to damage threads.

7. Bleed all brakes as outlined in Note 9.

c. Removal—Hydraulic Brake Hose (Rear Wheels)

1. Remove retainers securing forward end of brake hose to bracket.

2. Disconnect steel brake pipe from hose by turning steel tube connector nut out of hose fitting. Cap pipe.

3. Disconnect hose from junction block on rear axle.

d. Installation—Hydraulic Brake Hose (Rear Wheels)

1. Install hose in junction block on rear axle, tightening to 25 foot-pounds.

2. Connect brake hose to brake piping steel tube connector nut after installing hose through hole in mounting bracket.

3. Tighten fitting to 25 foot-pounds.

4. Install retainers securing forward end of hose to mounting bracket.

5. Bleed brakes as described in Note 9.

e. Removal—Hydraulic Brake Piping (Rear Wheels) Fig. 5-9

1. Disconnect steel brake piping at rear wheel cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.

2. Disconnect brake piping at T-connector on axle housing.

3. Remove piping from welded retainers on axle housing, and remove piping.

f. Installation—Hydraulic Brake Piping (Rear Wheels)

1. Install steel piping on welded retainers.

2. Connect piping at T-connector and tighten to 15 foot-pounds maximum.

3. Connect piping at wheel cylinder fitting, tightening to 20-30 foot-pounds.

4. Tamp welded retainers over piping enough to secure, being careful not to damage brake piping.

5. Bleed all brakes as outlined in Note 9.

12. Parking Brake Preliminary Checks

It is not always necessary to replace the parking brake assembly or vacuum cylinder assembly in cases of an inoperative parking brake automatic release. The following checks should be performed as part of your diagnosis to determine the cause and correction of parking brake trouble and to eliminate unnecessary replacement of parking brake components.

1. Check vacuum cylinder piston travel by running engine and moving transmission selector lever from Drive to Neutral. The manual release lever should move up and down as vacuum is applied and released. If no movement is observed, check vacuum system per steps 2 and 3. If movement is slow, (more than one or two seconds to complete the full stroke) cylinder is leaking. Replace vacuum cylinder as described in Note 14.

2. Check for damaged or kinked vacuum hoses and for loose hose connections at parking brake vacuum cylinder, vacuum release valve at neutral safety switch, and at engine manifold connection.

3. Check adjustment of neutral safety switch and operation of vacuum release valve. Correct as necessary and recheck parking brake operation.

4. Check brake release with vacuum applied. If vacuum cylinder piston completes full stroke but does not release brake, a malfunction of the pedal assembly is indicated. Replace complete parking brake assembly as described in Note 13.

5. Check operation of parking brake with engine off. Parking brake should remain engaged regardless of transmission selector lever position. If not, replace parking brake assembly.

13. Parking Brake Assembly

a. Removal

1. Remove steering column lower cover as explained in Section 12, Note 38a.

2. Place parking brake pedal in release position. Set transmission shift lever in Park position.

3. Working underneath car, remove equalizer nut and washer and separate cable stud from equalizer.

4. Disconnect parking brake vacuum hose at cylinder.

5. Position carpet and left cowl kick-pad out of the way.

6. Remove two parking brake assembly-to-instrument panel mounting bolts.

7. Remove two parking brake assembly-to-cowl mounting nuts and move assembly away from cowl.

8. Position brake pedal lever so that clevis on parking brake assembly is exposed, and remove brake cable end from clevis.

b. Installation

1. Position parking brake pedal so that clevis is exposed, and attach parking brake cable to clevis on parking brake assembly.

2. Place parking brake assembly on studs on cowl, attaching with two mounting nuts.

3. Install two parking brake assembly-to-instrument panel mounting bolts.

4. Connect hose to parking brake vacuum cylinder.

5. Replace cowl kick-pad and carpet.

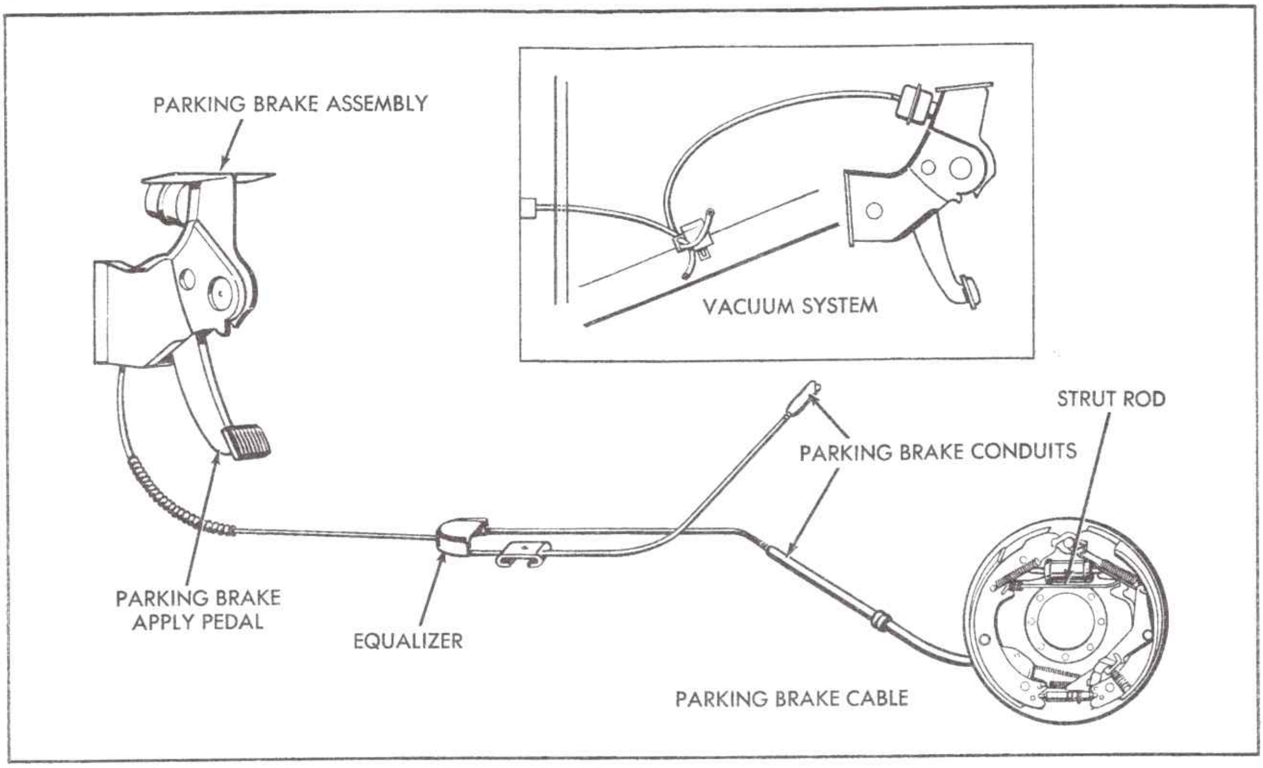


Fig. 5-10 Parking Brake Linkage

6. Insert cable stud through equalizer, making sure the rear cables are properly routed through equalizer and secured at C-shaped clamp, Fig. 5-10.

7. Install washer and equalizer nut.

8. Adjust parking brake as described in Note 2.

9. Check operation of automatic release.

10. Install steering column lower cover, as explained in Section 12, Note 38b.

14. Parking Brake Vacuum Cylinder

a. Removal

1. Remove parking brake assembly as described in Note 13.

2. Drill out one rivet that retains cylinder to parking brake assembly.

3. Detach link that connects cylinder to manual release lever and remove cylinder.

b. Installation

1. Position cylinder on parking brake assembly and secure with one rivet or bolt and nut.

2. Secure link to manual release lever.

3. Install parking brake assembly as described in Note 13.

4. Test automatic lock and release operations with engine running in Neutral and Drive ranges.

NOTE: Parking brake should release in any drive range with engine running, and should remain engaged in Neutral and Park with engine running.

15. Parking Brake Cables

a. Removal—Front Cable

1. Release parking brake.

2. Remove spring supporting front cable to underbody.

3. Disconnect cable stud at equalizer by removing equalizer nut and washer, Fig. 5-4, and separating cable stud from equalizer.

4. Remove U-shaped retainer at frame.

5. Depress pedal, and clamp vise grip pliers on cable at toe pan fitting.

6. Release pedal and remove cable end from parking brake assembly clevis.

7. Remove vise grip pliers.

8. Compress prongs on cable fitting at toe pan and push out cable assembly from inside car.

9. Pull cable through hole in frame and remove from car.

b. Installation—Front Cable

1. Insert cable through hole in frame.

2. Install U-shaped retainer at frame.

3. Install cable through cowl from under hood.

NOTE: Expanders on cable will "click" into position when cable is inserted through cowl.

4. Pull cable through from inside of car as far as possible, and clamp cable with vise grip pliers at toe pan fitting.

5. Install cable end to parking brake assembly clevis.

6. Remove pliers from cable.

7. Connect cable stud at equalizer by installing washer and nut.

8. Install spring supporting cable to underbody.

9. Check operation of parking brake system and adjust if necessary as outlined in Note 2.

c. Removal—Rear Cables

1. Release parking brake.

2. Raise rear of car and place on jack stands.

3. Remove rear wheel and drum on same side of car as parking brake cable being replaced.

4. Remove equalizer nut and washer, and separate equalizer from front cable stud.

5. Remove end of cable being replaced from C-clamp.

6. If left parking brake cable is being replaced, pry open ears of equalizer and remove cable from equalizer.

7. Remove horseshoe clip securing cable to front bracket and remove cable from bracket by pulling rearward.

8. If right cable is being replaced, remove four screws and clamps securing cable to floor pan.

9. Remove two screws securing parking brake cable clamp to brake backing plate.

10. Remove pawl spring and pawl lever from actuating lever.

11. Remove cable end from operating lever, and remove cable from backing plate.

d. Installation—Rear Cables

1. Route cable end through rear of backing plate and install on operating lever.

2. Install pawl lever and pawl spring.

3. Position parking brake cable clamp against backing plate, securing with two screws. Tighten screws to 11 foot-pounds.

CAUTION: Check operation of cable and brake shoes by pulling on front end of cable.

4. Route cable over top of rear suspension links.

5. If right cable is being installed, position cable against floor pan and secure with four clamps and screws.

6. Insert cable through hole in frame bracket and secure with horseshoe clip.

7. If left cable is being installed, install cable in equalizer slot and bend equalizer ears over cable. Brush small amount of lubricant in equalizer slot.

8. Install cable end in C-shaped clamp.

9. Insert front cable stud through equalizer hole and install equalizer washer and nut.

10. Install rear drum and wheel.

11. Adjust parking brake as described in Note 2.

16. Power Brake Unit

a. Removal

1. Disconnect hydraulic brake lines from master cylinder, Fig. 5-11. Cap line fittings to prevent dirt from entering brake lines.

2. Disconnect vacuum hose from vacuum check valve on power head.

3. Remove steering column lower cover as described in Section 12, Note 38a.

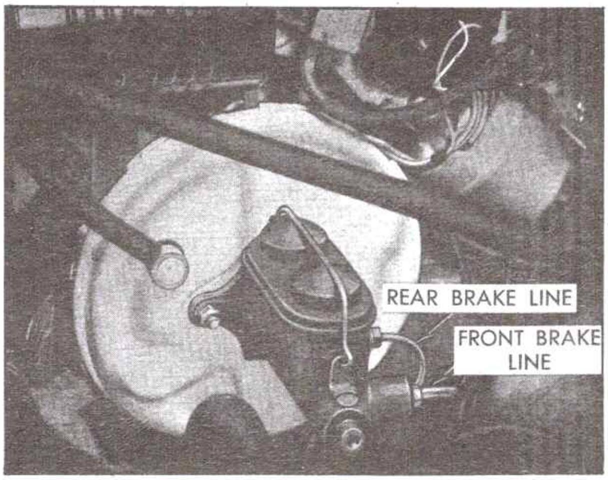


Fig. 5-11 Power Brake Unit Installed (Bendix)

4. Remove cotter pin, washer and spring spacer that attach power unit push rod to brake pedal arm.

5. Remove four nuts retaining power unit to cowl, and remove power unit from engine compartment.

b. Installation

1. Position power unit to cowl.

2. Working inside passenger compartment, loosely install four nuts retaining power unit to cowl.

3. Attach power unit push rod to brake pedal arm with spring spacer, washer and cotter pin.

4. Tighten four nuts retaining power unit to cowl to 16-22 foot-pounds.

5. Install steering column lower cover as described in Section 12, Note 38b.

6. Connect vacuum hose to check valve on power unit.

7. Connect hydraulic brake lines to master cylinder, tighten lines to 10 foot-pounds. Front wheel brake line connects to forward master cylinder reservoir.

8. Bleed brakes as described in Note 9.

17. Delco Moraine Power Head Disassembly, Cleaning, Inspection and Assembly, Fig. 5-15

a. Disassembly

1. Scribe a line on top center of front and rear shells of power head in line with master cylinder reservoir cover.

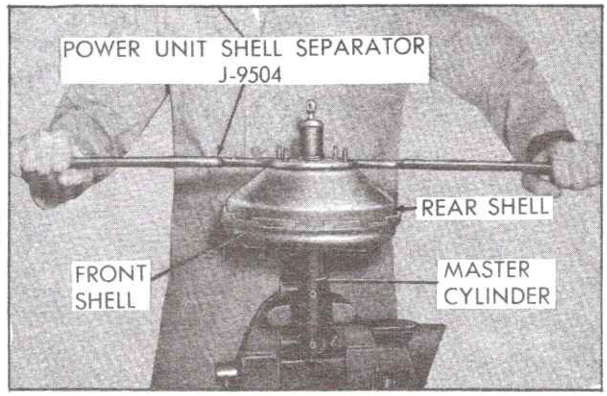


Fig. 5-12 Removing Delco - Moraine Power Head Rear Shell

2. Remove master cylinder reservoir cover and seal, and drain fluid from reservoirs. Push in on push rod several times to force fluid from master cylinder bore and to vent vacuum in power head.

3. Place assembly in bench vise with rear shell up, tighten vise jaws securely on master cylinder, Fig. 5-12, and remove dust guard retainer, dust guard and silencer from rear shell.

CAUTION: Avoid excessive tightening as master cylinder casting may crack.

Use care when removing separator tool as power piston return spring may cause rear shell to fly off when pressure is released.

4. Install Power Unit Shell Separator, J-9504, over mounting studs on rear shell, Fig. 5-12. Applying downward pressure, rotate rear shell counterclockwise, disengaging it from front shell.

5. Remove rear shell, power piston assembly and piston return spring, Fig. 5-13, from front shell.

6. Separate power piston assembly from rear shell and remove power piston bearing seal from center of rear shell.

7. Remove air filter and limiter washer from power piston insert tube surrounding push rod and remove filter from O.D. of tube.

8. Remove vacuum check valve and grommet from front shell.

9. Remove two self-locking nuts that hold master cylinder to front shell and remove front shell from master cylinder.

10. Remove vacuum seal from center of front shell.

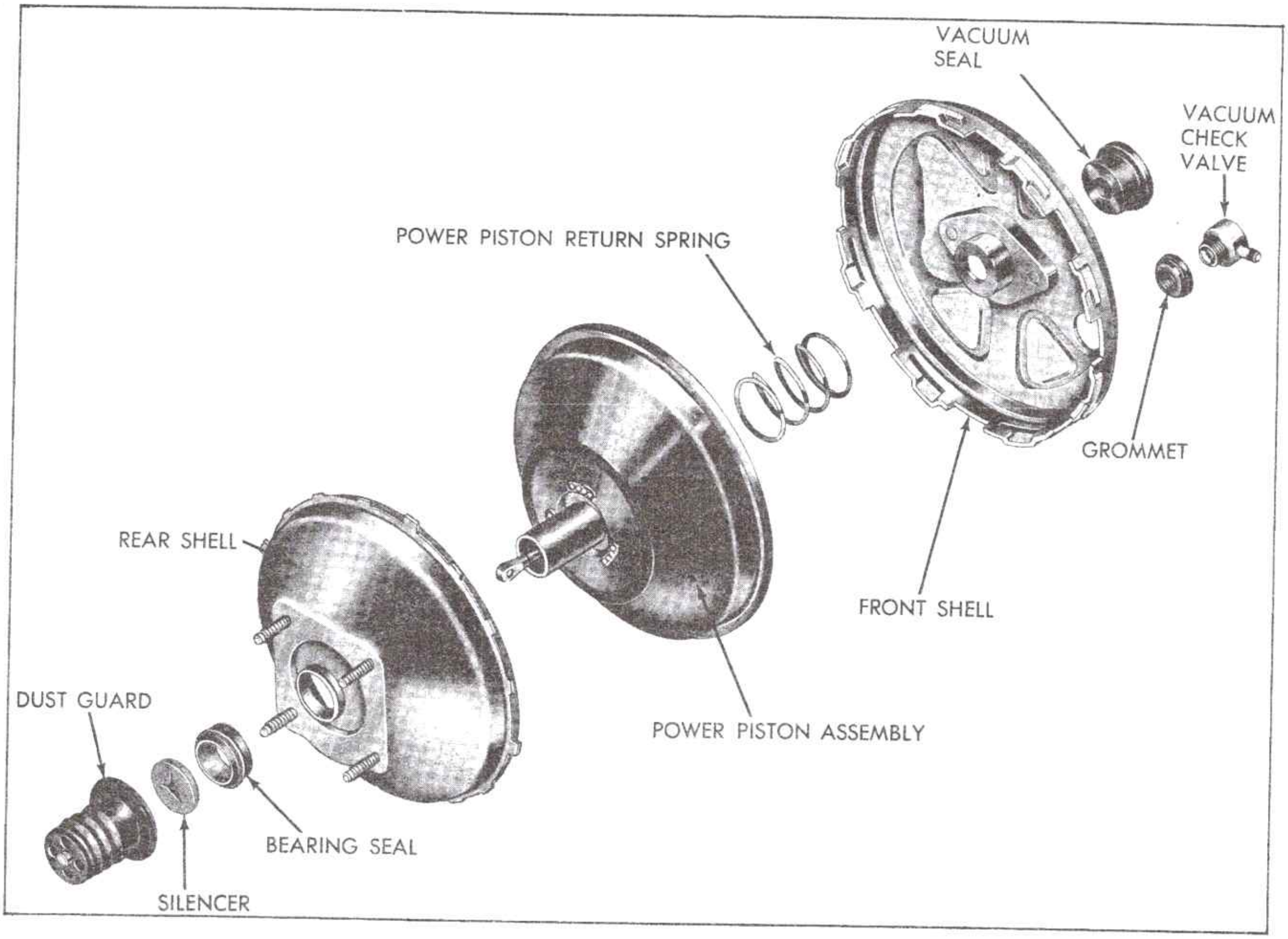


Fig. 5-13 Delco Moraine Power Head Disassembled

11. Remove master cylinder from vise, and clamp control valve and rod assembly in vise with power piston insert tube resting on top of vise jaws, Fig. 5-14.

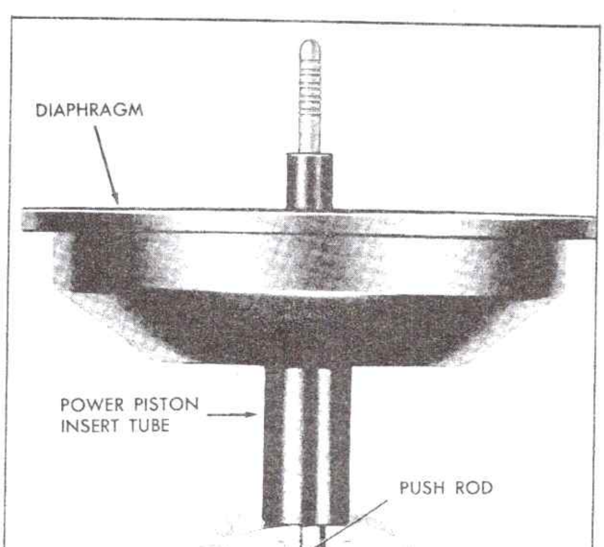


Fig. 5-14 Mounting Power Piston Assembly in Vise

12. Pry one end of lock ring from large divided locking lug on power piston insert, using a screwdriver, and remove lock ring.

13. Lift reaction retainer off power piston insert and then remove master cylinder push rod assembly from reaction retainer.

14. Remove O-ring from groove on rear end of master cylinder push rod.

15. Remove reaction plate, three reaction levers, reaction spring, air valve spring, reaction bumper and air valve spring retainer from power piston insert, Fig. 5-15.

16. Using Snap Ring Pliers #22, J-4880, remove snap ring from groove on end of air valve push rod.

17. Grasp power piston support plate firmly, and lifting upward, pull power piston insert off of control valve and rod assembly.

18. Remove air valve assembly from vise.

NOTE: The floating control valve and push rod are serviced as an assembly.

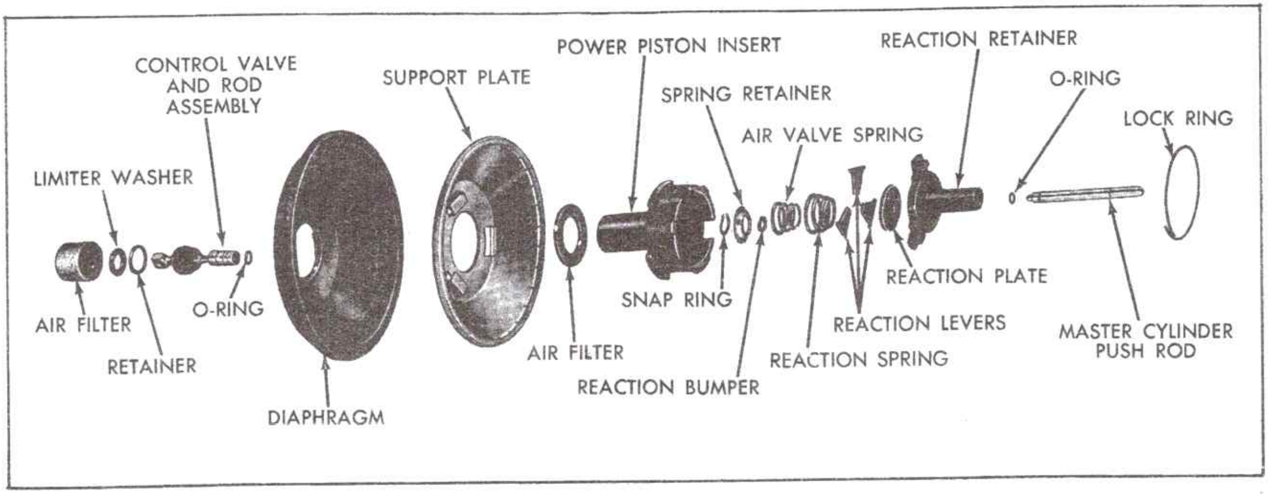


Fig. 5-15 Delco Moraine Power Piston Disassembled

19. Place square shank of Power Piston Insert Wrench, J-21524, in vise and position power piston assembly on wrench so that the three notches in the power piston housing fit over the ears of the tool, Fig. 5-16.

20. Rotate support plate counterclockwise until support plate separates from power piston insert, Fig. 5-16.

21. Remove diaphragm from the support plate.

b. Cleaning and Inspection

1. Thoroughly wash all parts in clean alcohol.

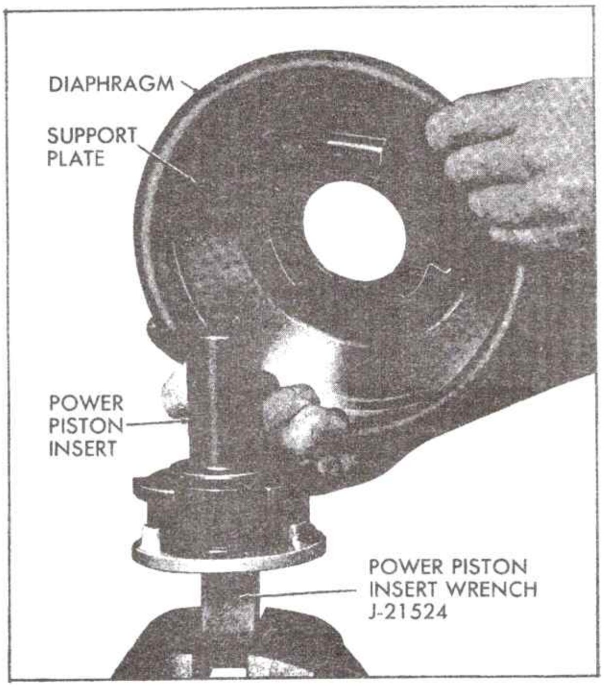


Fig. 5-16 Removing Power Piston Insert

CAUTION: Use of gasoline, kerosene, anti-freeze or any other cleaner with even a trace of mineral oil will damage rubber parts.

2. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.

3. If any rust is found inside front or rear shell, polish clean with crocus cloth or fine emery paper, washing clean afterwards.

4. Inspect front and rear shells for scratches, scores, pits, dents or other damage affecting rolling or sealing of diaphragm or other seals. Small imperfections may be smoothed out with fine crocus cloth.

5. Inspect all original parts, not being replaced by repair kit, for damage, distortion or excessive wear and replace as necessary.

6. Use all parts furnished in power head repair kit.

c. Assembly

Be sure all parts are clean before assembling unit. Do not let grease or mineral oil come in contact with any rubber parts.

Lubricate rubber parts of power piston group with special lubricant included in service repair kit.

1. Wipe a thin film of special lubricant on large O.D. of floating control valve and air valve O-ring.

2. Position control valve and rod assembly in neck of power piston insert tube and position retainer on top of control valve. Using Control Valve Assembly Installer, J-21601, seat assembly in tube, Fig. 5-17.

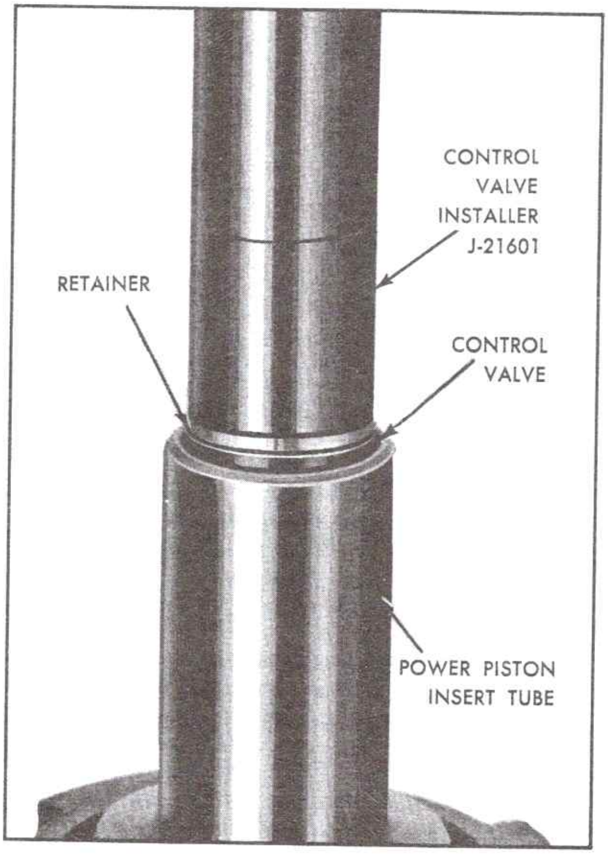


Fig. 5-17 Installing Control Valve Assembly

3. Install push rod limiter washer and air filter into neck of tube.

4. Using Snap Ring Pliers #22, J-4880, install new snap ring in groove on end of control valve and rod assembly.

CAUTION: Avoid over-expanding snap ring.

5. Assemble power piston diaphragm to support plate. Raised flange of diaphragm is pressed through center hole in support plate.

6. Place square shank of Power Piston Insert Wrench, J-21524, in vise and position power piston insert on wrench so that grooves in power piston fit over ears of tool.

7. Wipe a thin film of special lubricant on all surfaces of power piston diaphragm that contact power piston insert.

8. Position support plate on power piston insert and rotate support plate clockwise until the lugs of power piston insert lock against stops on support plate.

NOTE: Visually inspect assembly to make sure that lugs are against stops.

9. Install filter on O.D. of power piston insert tube.

10. Clamp control valve and rod assembly in vise with power piston insert tube resting on vise jaws, Fig. 5-14.

11. Seat air valve spring retainer on snap ring with large end down.

12. Install reaction bumper on end of control valve and rod assembly.

13. Place large diameter end of conical air valve spring on spring retainer.

14. Place reaction spring over air valve spring.

15. Position ears of reaction levers in molded locations in power piston insert and rest small ends of levers on air valve spring.

16. Center reaction plate on top of reaction levers.

17. Place new O-ring on groove on rear of master cylinder push rod and lubricate O-ring with special lubricant.

18. Push master cylinder push rod through reaction retainer.

19. Place small end of master cylinder push rod in reaction plate center hole and align retainer ears with grooves in power piston insert.

20. Place lock ring over reaction retainer. Press down and hold reaction retainer while installing lock ring by starting one end of ring under large divided locking ear on power piston insert. Complete installation by working ring over and under appropriate locking ears, Fig. 5-18.

21. Remove power piston assembly from vise and install master cylinder in vise, open end up.

CAUTION: Do not clamp on reservoir cover. Avoid excessive tightening as master cylinder casting may crack.

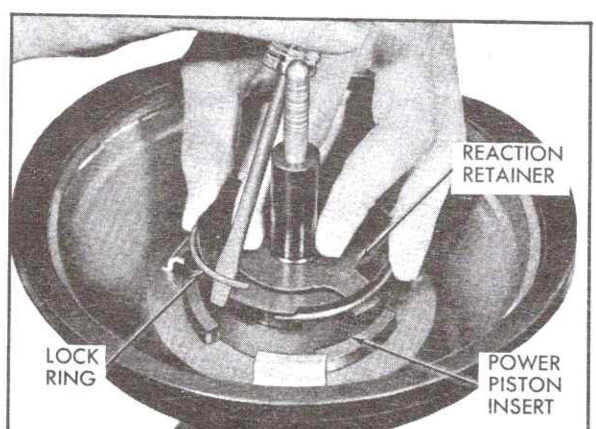


Fig. 5-18 Installing Power Piston Lock Ring

22. Position front shell studs through master cylinder mounting holes and install lockwashers and nuts finger tight.

23. Install new vacuum check valve grommet in front shell with large diameter outside.

24. Install vacuum check valve.

25. Install power piston return spring in front shell.

26. Install power piston bearing seal in center hole in rear shell with large flange outside. Lubricate grooves in I.D. of bearing with special lubricant.

NOTE: Flange of seal should contact shell.

27. Insert silencer in dust guard and install retainer on dust guard.

28. Install dust guard on rear shell by pressing retainer and guard over rear shell flange, and retainer over studs on rear shell.

29. Insert power piston, air valve push rod first, into rear shell. Tube of power piston fits through power piston bearing seal, and push rod fits through silencer and dust guard.

30. Position rear shell and power piston assembly onto front shell. Align scribe marks on shells so that scribe marks will line up when shells are rotated into locked position.

31. Pressing downward on rear shell, start locking tangs into grooves by rotating rear shell clockwise. Install Power Unit Shell Separator, J-9504, over mounting studs on rear shell and rotate shell clockwise against stops.

NOTE: Master cylinder push rod is designed to provide the correct relationship between vacuum piston and master cylinder piston. This height is important as it provides for the compensating port being kept open while unit is in released position. The push rod is at the correct height when assembled, and, under normal service, will not require adjustment. When unit has been disassembled and reassembled, however, height should be checked as follows:

32. Remove power head assembly from master cylinder.

33. Push master cylinder push rod in place and place Push Rod Height Gage, J-22647, in a position that will allow the gage to be moved to the left or right without contacting the studs.

34. The center section of the gage has two levels. The push rod end should touch the lower level of the gage, but should not touch the higher

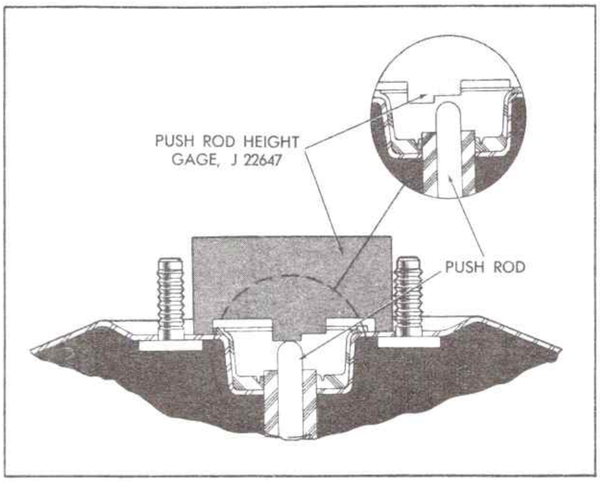


Fig. 5-19 Checking Delco-Moraine Push Rod Height

level. Move gage from side-to-side to check push rod height.

35. If push rod height does not check correctly, the non-adjustable push rod will have to be replaced with a service push rod that has a self-locking adjustment screw. Proceed as follows:

a. Pull master cylinder push rod assembly straight out from reaction retainer.

b. Remove O-ring from push rod and inspect for damage. If it appears usable, place on service push rod, lubricate with special lubricant and push service push rod straight into reaction retainer until it bottoms.

c. Repeat steps 33 and 34.

d. If adjustment is needed, turn adjusting screw in or out as required.

36. Wipe a thin film of lubricant on new vacuum seal.

37. Install vacuum seal in outside center of front shell.

38. Install vacuum power head on master cylinder with check valve toward reservoir cover, and torque nuts to 20 foot-pounds.

18. Delco Moraine Master Cylinder Disassembly, Cleaning, Inspection and Assembly, Fig. 5-20

a. Disassembly

NOTE: If trouble has been traced to hydraulic system, master cylinder may be removed from power head without removing power head from car. Area surrounding master cylinder mounting surface must be kept clean.

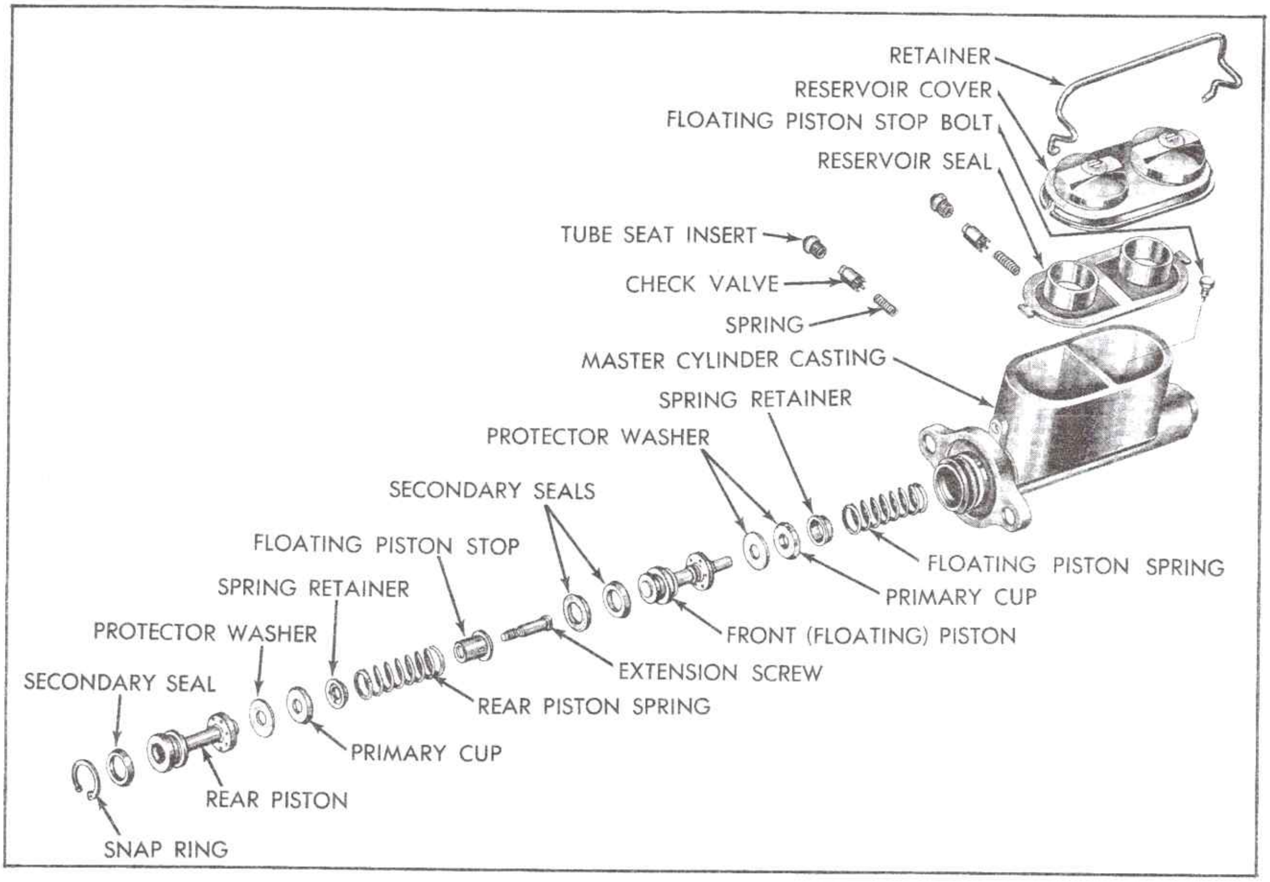


Fig. 5-20 Delco Moraine Master Cylinder Disassembled

1. Disconnect and cap front and rear brake lines if not done previously.

2. Remove two self-locking nuts that hold master cylinder to power head and remove master cylinder.

3. Pry bale type retainer off of reservoir cover, and remove reservoir cover and seal. Drain brake fluid from reservoirs.

4. Remove seal from reservoir cover.

5. Remove lock ring from open end of master cylinder.

6. Remove floating piston stop bolt from front fluid reservoir and remove rear piston assembly.

7. Firmly rap master cylinder on a block of wood until floating piston drops in bore and remove front (floating) piston assembly, retainer and spring.

CAUTION: Check progress of floating piston dropping in bore to avoid striking piston on wood. If floating piston sticks in bore, blow compressed air through front brake outlet hole.

8. Place master cylinder in vise with outlet holes up.

9. Install a spare brake line tube nut in outlet hole, place a flat washer on a 1 inch #6-32 screw and thread screw into threaded hole in tube seat insert, Fig. 5-21.

NOTE: Before installing screw, run a #6-32 tap into hole to clean up threads.

10. To pull insert, hold screw from turning and turn tube nut out of outlet hole, Fig. 5-21. Remove both inserts in this manner and discard.

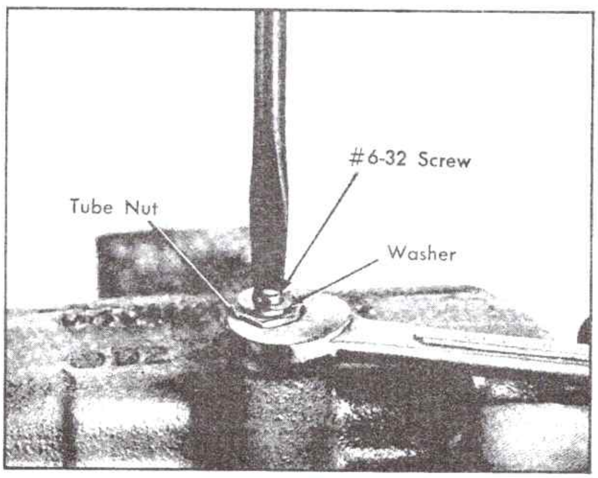


Fig. 5-21 Removing Tube Seat Inserts

11. From cavity beneath each tube insert, remove rubber check valve and check valve spring, Fig. 5-20.

12. Remove the primary seal, primary seal protector and secondary seals from the front (floating) piston.

13. Remove piston extension screw from center of floating piston stop and remove floating piston stop and spring from rear piston.

NOTE: If necessary, grasp the unfinished piston body immediately under flange containing compensating holes with a pair of pliers to remove piston extension screw.

14. Remove spring retainer, primary seal, primary seal protector and secondary seal from the rear piston.

b. Cleaning and Inspection

1. Inspect master cylinder bore for scoring, pitting or etching. Any of these will require replacement of master cylinder casting.

2. Examine fluid reservoir for foreign matter, and check all passages for restrictions. If there is any suspicion of contamination or evidence of corrosion, completely flush hydraulic system, using clean brake fluid.

3. Inspect floating piston for severe scoring, pitting or distortion. Any of these will require replacement of master cylinder assembly.

NOTE: Floating piston may show a wear pattern; however, do not replace assembly unless wear is severe.

4. Thoroughly wash all parts in clean alcohol, including new parts to be used in assembly of master cylinder.

CAUTION: Use of gasoline, kerosene, antifreeze, or any other cleaner with even a trace of mineral oil will damage rubber parts.

5. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.

6. When overhauling a master cylinder, use all parts furnished in master cylinder repair kit.

c. Assembly

Be sure all parts are clean before assembling master cylinder. Do not let grease or mineral oil come in contact with any rubber parts.

Lubricate rubber parts with clean brake fluid only.

1. Position master cylinder in vise with outlet holes up, and install valve springs in outlet holes so that they seat in depression in bottom of holes, Fig. 5-20.

2. Install new rubber check valves over springs, being careful not to displace springs from their seats. When check valve is properly seated, end of valve will be even with machined top of outlet boss.

3. Position new brass tube inserts in outlet holes. Thread spare brake line tube nut into each outlet hole and turn nuts down until inserts bottom.

4. Remove tube nuts and check both outlet holes for loose brass burrs.

5. Install new secondary seal in center groove of floating piston. Lip of seal should face toward compensating holes in opposite end of piston.

6. Install new secondary seal in groove at end of floating piston, back-to-back with secondary seal in center groove, Fig. 5-20, so that lips face toward that end.

7. Install primary seal protector and primary seal over end of floating piston opposite secondary seals. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.

8. Install secondary seal in groove on push rod end of rear piston. Lip of seal should face toward compensating holes in opposite end of piston.

9. Install primary seal protector and primary seal on opposite end of rear piston. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.

10. Position spring retainer on one end of rear piston spring and floating piston stop on other end.

11. Position spring assembly on rear piston with spring retainer seated inside lips of primary cup.

12. Insert piston extension screw in center of floating piston stop.

13. Compress primary piston spring and start piston extension screw in hole in end of piston, release spring and turn down screw. Torque to 7-8 foot-pounds.

14. Position retainer in floating piston spring and position spring assembly on floating piston with retainer seated inside lips of primary cup.

15. Coat master cylinder bore, primary seal and secondary seals on floating piston with clean brake fluid.

16. Position master cylinder casting in vise so that open end of bore is down slightly and install floating piston assembly in bore, spring end first, until assembly bottoms in bore.

17. Reposition master cylinder in vise so that open end is up.

18. Coat primary and secondary seals on rear piston assembly with clean brake fluid and insert assembly into master cylinder bore, spring end first.

19. Pressing downward on rear piston, install lock ring in groove in master cylinder piston.

20. Install floating piston stop bolt in front fluid reservoir, tightening to 2-3 foot-pounds.

21. Install new reservoir seal on reservoir cover, place cover on master cylinder, retaining with bale-type retainer.

22. Install master cylinder on power head, torquing nuts to 20 foot-pounds.

23. Install front and rear brake lines, if power head is on car, tightening lines to 15 foot-pounds and bleed brakes as described in Note 9.

19. Bendix Power Head Disassembly, Cleaning, Inspection and Assembly, Fig. 5-22

a. Disassembly

1. Scribe a line on top center of front and rear shells of power head in line with master cylinder reservoir cover.

2. Remove master cylinder reservoir cover and seal, and drain fluid from reservoirs. Push in on push rod several times to force fluid from master cylinder bore and to vent vacuum in power head.

3. Place assembly in bench vise with rear shell up, tighten vise jaws securely on master cylinder, Fig. 5-12, and remove dust guard and air silencers from rear shell.

CAUTION: Avoid excessive tightening as master cylinder may crack.

Use care when removing separator tool as power piston return spring may cause rear shell to fly off when pressure is released.

4. Install Power Unit Shell Separator, J-9504, over mounting studs on rear shell. Applying downward pressure, rotate rear shell clockwise to disengage from front shell, Fig. 5-12.

5. Remove rear shell, diaphragm plate assembly and piston return spring.

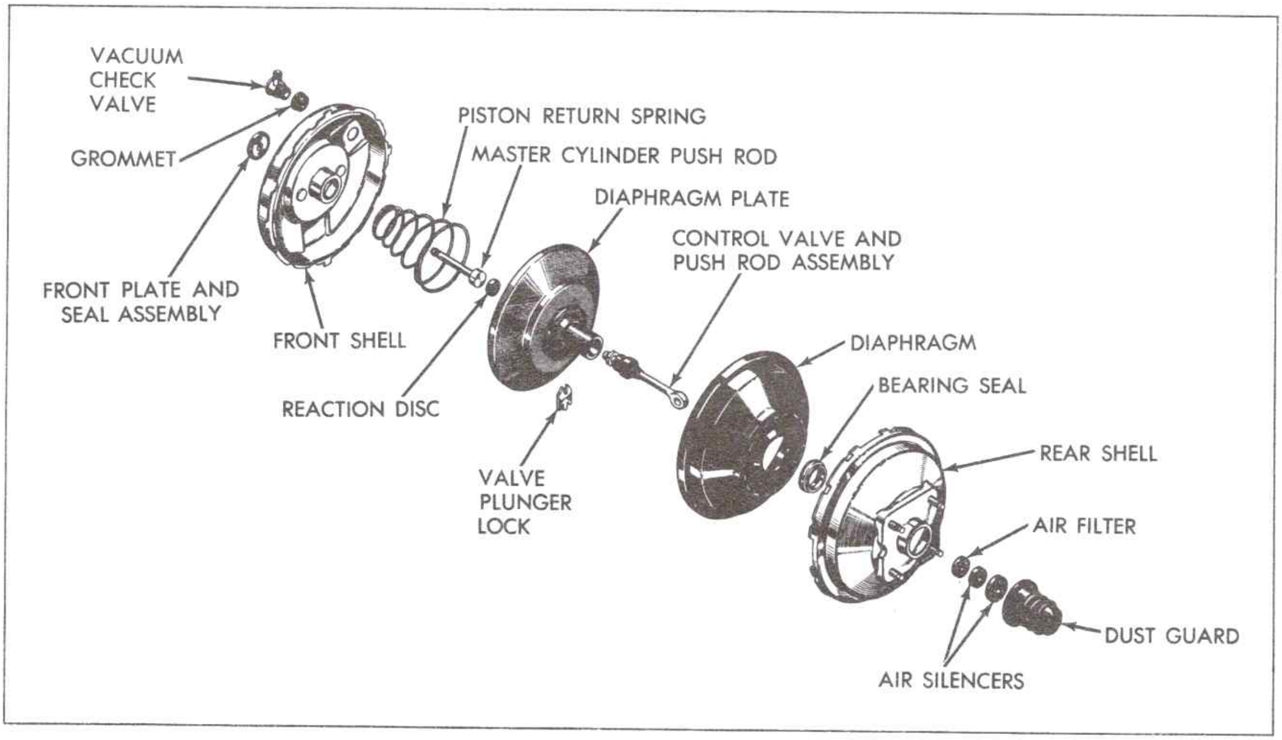


Fig. 5-22 Bendix Power Head Disassembled

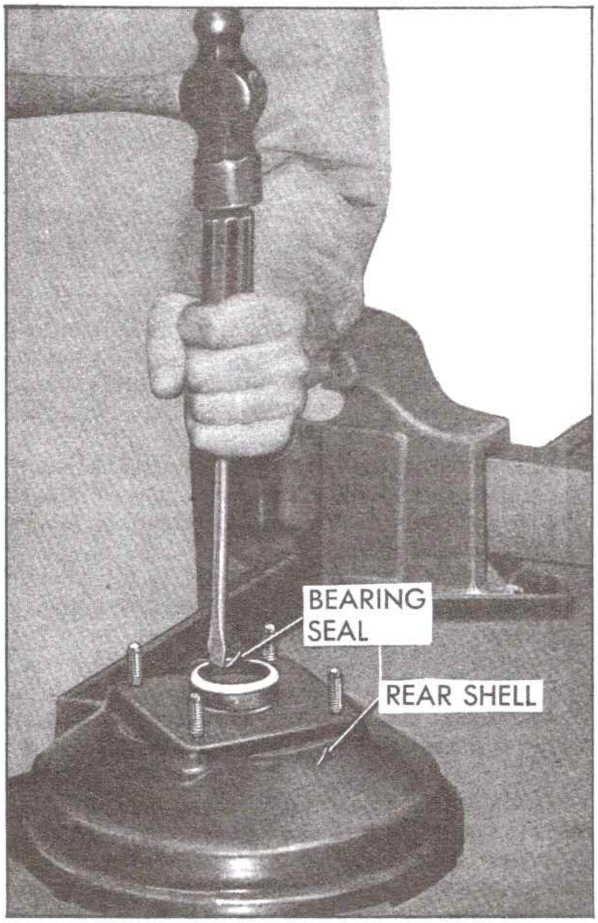


Fig. 5-23 Removing Bearing Seal from Rear Shell

6. Remove second air silencer, if not removed previously, and air filter from diaphragm plate hub.

7. Remove rear shell from diaphragm plate assembly and remove diaphragm from diaphragm plate.

8. Set diaphragm plate on edge with valve plunger lock downward, push in on push rod, allowing valve plunger lock to fall out.

9. Remove control valve and push rod assembly from diaphragm plate hub.

10. Remove master cylinder push rod and rubber reaction disc from diaphragm plate.

11. Remove two nuts and lockwashers that hold master cylinder to front shell and separate front shell from master cylinder, leaving master cylinder in vise.

12. Remove front plate and seal assembly from center of front shell.

13. Remove vacuum check valve and grommet from front shell.

14. Place rear shell on bench with mounting studs up, and drive out bearing seal with screwdriver or punch, Fig. 5-23.

b. Cleaning and Inspection

Perform cleaning and inspection procedures as described in Note 17b.

c. Assembly

Be sure all parts are clean before assembling unit. Do not let grease or mineral oil come into contact with any rubber parts.

Lubricate rubber parts of power piston group with special lubricant included in service repair kit.

1. Place rear shell on bench with mounting studs down. Place new bearing seal on Bearing Seal Installer, J-22677, with plastic side of seal against installer and drive seal into shell until seal is seated in shell, Fig. 5-24.

2. Apply special lubricant to I.D. of diaphragm plate hub.

3. Insert new control valve and push rod assembly into diaphragm plate hub, after applying special lubricant to bearing surfaces of valve plunger and to outer edge of poppet valve.

4. Set diaphragm plate on edge, with valve plunger lock slot up, and insert valve plunger lock in slot. Push in on push rod until valve plunger lock drops into position.

5. Install new diaphragm in groove of diaphragm plate.

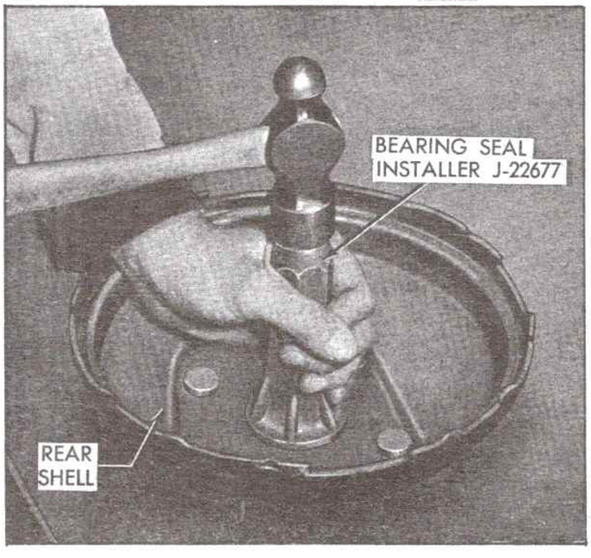


Fig. 5-24 Installing Bearing Seal in Rear Shell

6. Slide new air filter and new air silencer over push rod end and guide into place in diaphragm plate hub, using care not to scratch or damage plastic hub.

7. Apply special lubricant to I.D. of bearing seal in rear shell and install diaphragm plate assembly into rear shell, guiding hub through bearing seal.

8. Apply special lubricant to entire surface of new reaction disc and position in diaphragm plate.

9. Install new vacuum check valve grommet in front shell with large diameter outside, and install vacuum check valve.

10. Install front shell of power head on master cylinder with mounting bolts through holes in flange. Install lockwasher and nuts finger tight.

11. Install conical piston return spring in front shell with smaller end down.

12. Position rear shell and diaphragm plate assembly on piston return spring. Align scribe marks on front and rear shells so that when shells are rotated in locked position, scribe marks will line up.

13. Pressing downward on rear shell, start locking tangs into grooves by rotating rear shell counterclockwise. Install Power Unit Shell Separator, J-9504, over mounting studs on rear shell and rotate rear shell counterclockwise against stops.

14. Install second air filter over push rod end and install new dust guard over diaphragm plate on rear shell.

15. Remove power head from master cylinder and place on bench.

16. Apply special lubricant to piston end of master cylinder push rod and insert push rod into

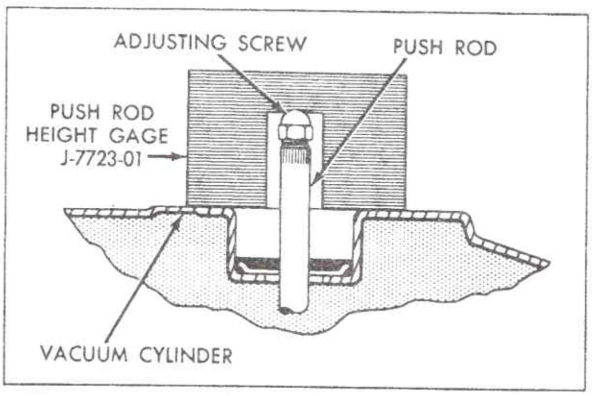


Fig. 5-25 Checking Bendix Push Rod Height

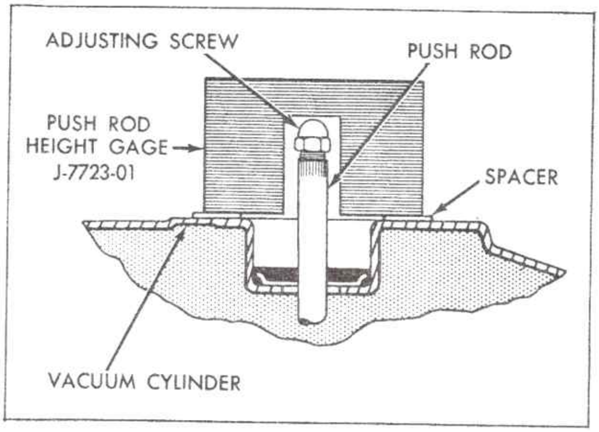


Fig. 5-26 Checking Bendix Push Rod Height with Spacer

diaphragm plate. Press and twist push rod to make certain rod is bottomed on reaction disc in plate.

CAUTION: When applying special lubricant to master cylinder push rod, use care so as not to get any lubricant on adjusting nut end of push rod.

17. Apply special lubricant to I.D. and O.D. of new front plate and seal assembly and install new front plate and seal assembly in center hole of front shell over push rod shaft.

NOTE: The push rod is designed with a self-locking adjustment screw to provide the correct relationship between vacuum piston and master cylinder piston. This adjustment is important as it provides for the compensating port being kept open while unit is in released position. Adjustment screw is set to the correct height when assembled, and under normal service, will not require further adjustment. After unit has been disassembled, however, the height should be checked as follows:

18. Place Push Rod Height Gage, J-7723-01, over push rod with legs of Gage resting on front shell, Fig. 5-25. Top of screw should touch gage.

19. Place a .030 inch spacer under legs of gage on front shell. Top of screw should clear gage, Fig. 5-26.

20. If adjustment is necessary, grasp push rod with pliers at serrated end and turn adjusting screw either in or out as required.

21. Attach master cylinder to power head with lockwashers and nuts, tightening nuts to 20 foot-pounds.

22. Remove assembly from vise.

20. Bendix Master Cylinder Disassembly, Cleaning, Inspection and Assembly, Fig. 5-27

a. Disassembly

NOTE: If trouble has been traced to hydraulic system, master cylinder may be removed from vacuum head without removing complete power brake assembly from car. Area surrounding master cylinder mounting surface must be kept clean.

1. Disconnect and cap front and rear brake lines if not done previously.

2. Remove two nuts and lockwashers and remove master cylinder from power head.

3. Pry bale-type retainer off of reservoir cover and remove reservoir cover and seal.

4. Remove seal from reservoir cover.

5. Drain brake fluid from master cylinder

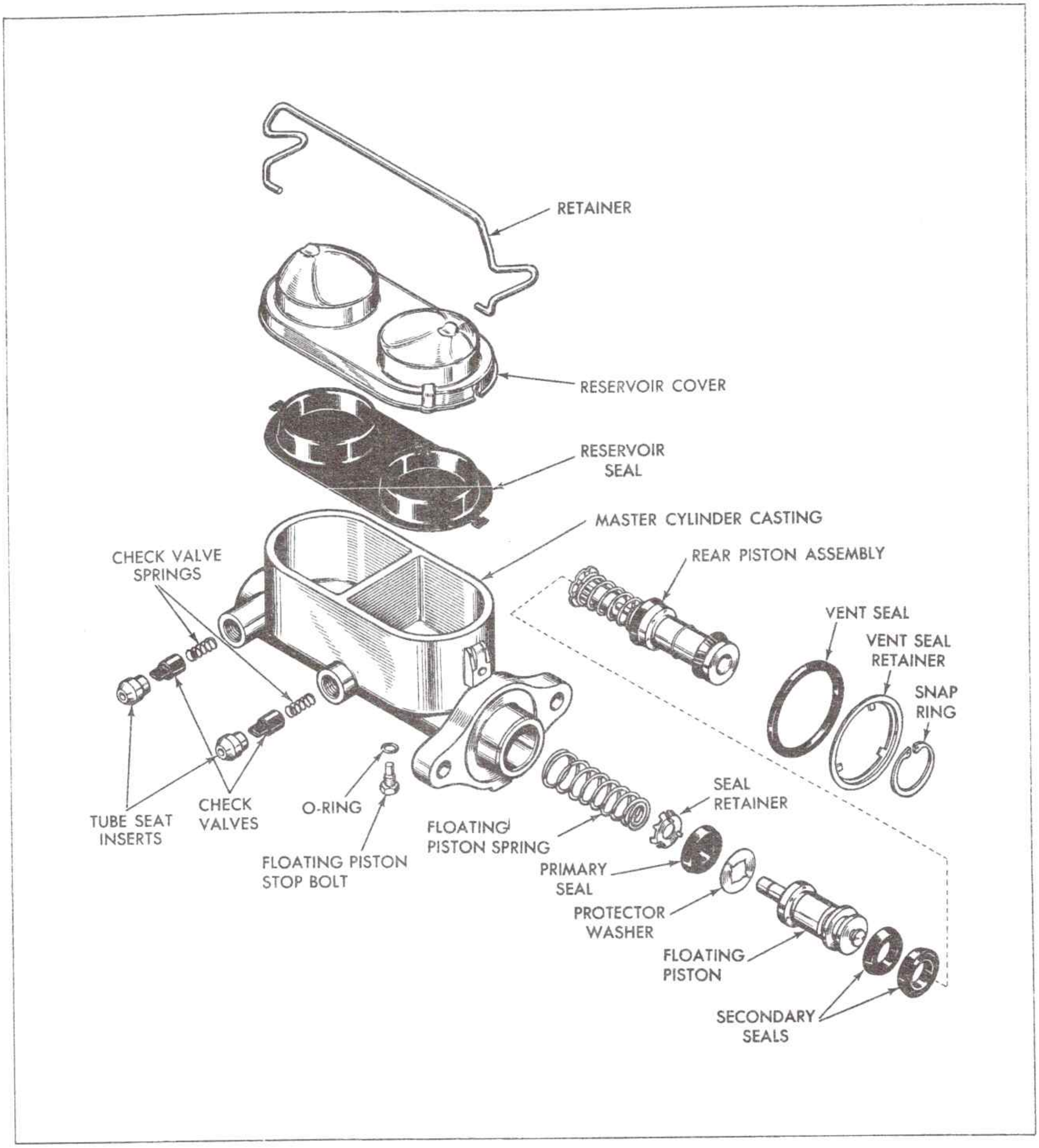


Fig. 5-27 Bendix Master Cylinder Disassembled

reservoirs and position master cylinder in vise with reservoir opening down.

CAUTION: Avoid excessive clamping as master cylinder casting may crack.

6. Tap hole in tube seat insert, using a #6-32 tap.

7. Install a spare brake line tube nut in outlet hole. Place flat washer on 1 inch #6-32 screw and thread screw into threaded hole in tube seat insert.

8. To pull insert, hold screw from turning and turn tube nut out of outlet hole, Fig. 5-21. Remove both inserts in this manner.

9. Remove check valves and check valve springs.

10. Pushing in on rear piston, remove front (floating) piston stop bolt from boss on underside of master cylinder casting.

11. Remove and discard O-ring from floating piston stop bolt.

12. Pushing in on rear piston, remove snap ring from groove in master cylinder bore.

13. Remove rear piston assembly from master cylinder bore.

14. Reaching into master cylinder bore with a mechanical finger, grasp small flange on end of floating piston and remove piston from bore.

NOTE: If a mechanical finger is not available, bend the blade of an old screwdriver 90°, approximately 3/8 inch from tip, and remove floating piston by hooking tip on piston flange.

15. Remove spring, seal retainer, primary seal and protector washer from front end of floating piston.

16. Remove "back-to-back" secondary seals from opposite end of floating piston.

17. Remove vent seal retainer and vent seal from extension.

b. Cleaning and Inspection

Perform cleaning and inspection procedures as described in Note 18b.

c. Assembly

Be sure all parts are clean before assembling master cylinder. Do not let grease or mineral oil come in contact with any rubber parts.

Lubricate rubber parts with clean brake fluid only.

1. Position master cylinder in vise with outlet holes up, using care to avoid scratching reservoir seal surface, and install check valve springs in outlet holes so that they seat in depressions in bottom of holes.

2. Install new rubber check valves over springs, being careful not to dislodge springs from their seats. When check valve is properly seated, end of valve will be even with machined top of outlet boss.

3. Position a new brass tube insert in outlet holes. Thread spare brake line tube nut into each outlet and turn nuts down until inserts bottom.

4. Remove tube nuts and check holes for brass burrs.

5. Install two new secondary seals "back-to-back" in grooves at blunt end of floating piston.

6. Install protector washer and new primary seal on other end of floating piston. Protector washer seats against flange containing compensating holes and flat side of seal seats against washer.

7. Place seal retainer on primary seal. Side with three tabs should be positioned toward seal.

8. Install small end of conical floating piston spring over spring pilot on end of floating piston, seating spring on seal retainer.

9. Remove master cylinder from vise. Coat master cylinder bore and piston assemblies with clean brake fluid.

10. Position master cylinder in vise with open end of bore up and insert floating piston assembly, spring end first, into master cylinder bore.

11. Insert new rear piston assembly, spring end first, into master cylinder bore.

12. Pushing in on rear piston, install snap ring in groove in master cylinder bore.

13. Install a new O-ring in groove on floating piston stop bolt and lubricate with clean brake fluid.

14. Pushing in on rear piston, install stop bolt in boss on underside of master cylinder. Torque bolts to 3-4 foot-pounds.

15. Install new vent seal and retainer on master cylinder extension.

16. Install new seal on reservoir cover and position cover assembly on master cylinder.

17. Install bale-type retainer if removed, and press retainer into depressions on top of cover.

18. Position master cylinder to power head and install lockwashers and nuts, tightening nuts to 15 foot-pounds.

19. Connect front and rear brake lines if master cylinder was installed to power head on car, tightening to 20 foot-pounds.

20. Bleed brakes as described in Note 9.

21. Testing Brake System

1. With engine running at idle and transmission in Neutral, depress brake pedal and hold foot pressure on pedal. If pedal gradually falls away under foot pressure, hydraulic system is leaking.

2. If hydraulic system is not leaking, but pedal travels more than 1-3/4 inch on new cars, or 1-1/2 inch on cars driven 500 miles or more since brake service work has been performed, brake shoe adjusters are not functioning, shoes require relining, front or rear hydraulic systems may have lost their fluid, or air may be present in hydraulic system - check accordingly.

3. With brakes off, operate engine at medium speed, then back to idle and turn off ignition. Wait at least two minutes, then try brake action. If not vacuum assisted for two or more applications, vacuum check valve is faulty or there is a leak in vacuum system.

4. With vacuum depleted from system, depress brake pedal, hold light foot pressure on pedal, and start engine. If vacuum system is operating, pedal will tend to fall away under foot pressure, and less pressure will be required to hold pedal in applied position. If no action is felt, vacuum system is not functioning.

5. Road test brakes by making a brake application at various speeds to determine if car stops evenly and effectively.

DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive brake pedal travel.	Uneven wear on linings.	Replace shoe and linings.
	No fluid in reservoir.	Add fluid, inspect for leakage, and bleed system.
	Leaking front or rear brake line.	Tighten or replace.
	Air in brake system.	Bleed system. Check for shrunken or swollen wheel cylinder piston cups, and if noted replace and correct cause.
		Check residual check valves and replace if faulty.
	Wheel cylinder piston cups swollen by mineral oil in system, or sub-standard brake fluid.	Disassemble all hydraulic parts and wash with alcohol. Dry with compressed air before assembly to keep alcohol out of system.
		Replace all rubber parts in system, including hoses.
		Replace brake shoe assemblies or linings if glazed by brake fluid leakage.
		Refill with heavy duty brake fluid and bleed system.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Excessive brake pedal travel (Cont'd.)	Leaking master cylinder piston cups.	Replace.
	Disconnected unit linkage.	Connect.
	Cracked master cylinder casting.	Replace.
	Brake shoes improperly adjusted.	Check automatic adjusters and make necessary adjustments.
	Excessive heat causing fluid to vaporize.	Check parking brake adjustment and make corrections as required.
		Determine whether one or more wheels are dragging and heating, and correct.
		Check for interference of brake pipe to engine exhaust system and correct.
		Be sure heavy duty brake fluid is used. If in doubt, drain, flush and refill.
Excessive brake pedal effort.	Faulty vacuum check valve.	Replace.
	Collapsed vacuum hose.	Replace or correct.
	Plugged vacuum hose or fittings.	Clean or replace.
	Leaking front or rear brake line.	Repair or replace.
	Pedal mechanism binding.	Repair.
	Restricted air filter.	Clean.
	Vacuum leak in unit.	Repair or replace.
	Defective rolling diaphragm.	Replace.
	Lining glazed due to light traffic use.	Resurface lining with medium sandpaper.
	Incorrect linings used.	Replace brake shoes or install new linings.
Car pulls to one side when brakes are applied.	Front wheel caster-camber misadjusted.	Correct as required until car has no "lead" without brakes applied.
	Weak or improperly installed shoe retracting springs.	Replace retracting springs as required.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Car pulls to one side when brakes are applied (Cont'd.)	Oil or brake fluid on linings.	Replace brake shoe assemblies or install new linings. Oil soaked linings cannot be cleaned and used again successfully. Also correct condition which caused linings to become soaked.
	Lining surface contaminated or slightly charred from fast break-in.	Sand lining surface.
	Different makes of linings used between left and right sides.	Different makes of lining have different braking efficiency. Replace brake shoes or install new linings on both sides.
	One wheel drags.	Make corrections to brakes as required.
	Scored brake drums.	Machine left and right brake drums or replace both if more than .030 inch radius has to be removed.
	Pinched brake lines.	Replace line.
	Drums have different friction between left and right sides. Visual inspection will show appreciable difference in porosity.	Machine both drums and sand linings or replace as required.
Brakes drag at all wheels.	Compensating ports in master cylinder reservoir not opening.	Check for swollen seals. If seals are swollen, replace all seals and fluid in entire system. Check vacuum piston to hydraulic piston push rod for correct adjustment.
	Brake pedal return travel restricted.	Check for obstruction or binding.
Springy pedal action.	Air in brake system.	Bleed system.
		Investigate and correct cause of air being drawn into system.
	Brake shoes improperly adjusted.	Correct malfunction of automatic adjusters as required.
	Improper fit of new lining to brake drums.	Install shoe and lining assemblies which are ground to fit. Follow break-in procedure for new lining.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Too light pedal pressure (brake action severe).	Linings damaged by excessive heat.	Replace shoe and linings.
	Oil or fluid on linings.	Replace brake shoe assemblies or install new linings. Linings cannot be cleaned and used again successfully. Correct leaks.
Squeaking during application or release.	Insufficient lubricant at brake shoe guide pads.	Apply special heat resistant lubricant as required.
Brake squeal or squeak during stop.	Lining making poor contact with drum (excessive edge contact).	Check wear pattern. Sand or file to produce more uniform contact. If lining is new, follow break-in procedure.
	Steel washer on "star wheel" bent, broken or missing.	Replace steel washer.
	Insufficient shoe retention.	Inspect shoe stabilizer plates for proper installation and spring tension. Replace springs as required.
	Drum vibration.	Install kit.
Brakes slow to respond.	Bent or dented vacuum cylinder.	Replace.
	Restricted air passage in power piston.	Remove or replace.
	Broken vacuum piston return spring.	Replace.
	Faulty hydraulic check valves.	Replace.
	Air valve sticking.	Clean or replace.
	Tight pedal linkage.	Repair.
Chatter	Brake drum ovality, sometimes combined with internal stresses in drum.	Take light cut on front and/or rear drums, as required, in pairs.
	Wheels and tires out of balance.	Balance wheels and tires.
	Improperly torqued wheel nuts.	Check and torque to specifications.
	Improperly torqued body mounts and tie struts.	Check and torque to specifications.

TORQUE SPECIFICATIONS

Material Number	Application	Size	Foot-Pounds
Special	Pipe Nut to Master Cylinder	1/2-20 or 9/16-18	25
260M	Parking Brake Cable Clamps (at Backing Plate)	5/16-24	11
Special	Pipe Nut to Flex Hoses	7/16-24	25
Special	Pipe Nut to Wheel Cylinder	7/16-24	20
300M	Front Backing Plate to Knuckle	1/2-20	65
Special	Brake Hose to Wheel Cylinder	7/16-20	25
300M	Brake Backing Plate to Rear Axle Housing . .	3/8-24	40
300M	Front Brake Anchor Pin to Knuckle	9/16-18	100
284M	Brake Unit to Cowl	3/8-24	18
286M	Brake Pedal Pivot Bolt	7/16-24	15
Special	Pipe Nut to Brass Connector	7/16-24	15
286M	Master Cylinder to Vacuum Power Head	3/8-24	20
Special	Piston Extension Screw (Delco)	Special	90*
Special	Floating Piston Stop Bolt (Delco)	10-24	30*
Special	Floating Piston Stop Bolt (Bendix)	5/16-24	40*
	*Inch-Pounds		

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.

SPECIFICATIONS

Item	All Series, Except 693 Unless Otherwise Noted
Braking Area (in square inches)	
Front	189
Rear	189
Lining Area (in square inches)	
Front	117
Rear	117
Wheel Cylinder Bore	
Front	1-3/16"
Rear - 680, 681, 682 and 683	15/16"
Rear - 697	1"
Rear - 698	1-1/8"
Drums (inside diameter)	12.00"
Remachined Drum Diameter (maximum)	12.060"
Variations of Inside Diameter (maximum)	
Front	.0008"
Rear	.0015"
Run-Out of Inside Diameter (maximum)	.005"
Clearance Between Secondary Linings and Drums	.010"-.030"
Primary Linings (length, width, thickness in inches)	
Front	11.00 x 2.50 x .26
Rear - 680, 681, 682 and 683	11.00 x 2.50 x .23
Rear - 697 and 698	11.00 x 2.50 x .26
Secondary Linings (length, width, thickness in inches)	
Front	12.36 x 2.50 x .28
Rear - 680, 681, 682 and 683	12.36 x 2.50 x .26
Rear - 697 and 698	12.36 x 2.50 x .28
Lining to Shoe Attachment Method	Rivets

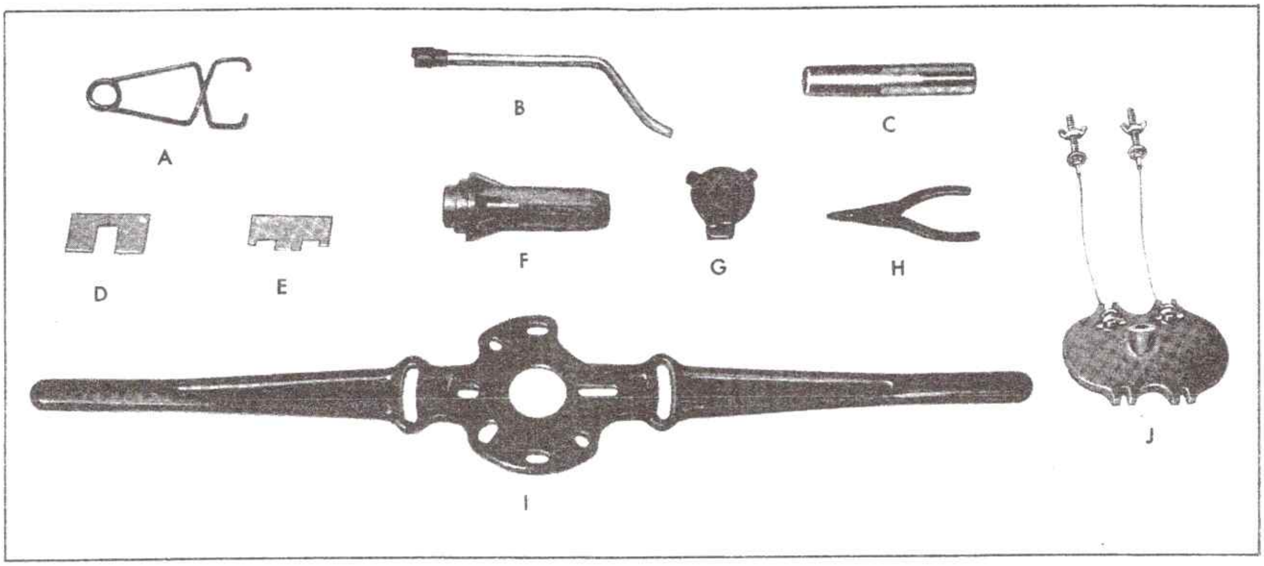


Fig. 5-28 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8001	Wheel Cylinder Clamp	F	J-22677	Bearing Seal Installer
B	J-8049	Brake Spring Remover and Installer	G	J-21524	Power Piston Insert Wrench
C	J-21601	Control Valve Installer	H	J-4880	Snap Ring Pliers (#22)
D	J-7723-01	Push Rod Height Gage (Bendix)	I	J-9504	Power Unit Shell Separator
E	J-22647	Push Rod Height Gage (Delco-Moraine)	J	J-22489-1	Bleeder Adapter Cover

GENERAL DESCRIPTION

NOTE: The following information pertains only to the Fleetwood Eldorado.

The braking system used on the 1967 Fleetwood Eldorado consists of power-assisted, hydraulic front and rear service brakes and a foot-operated, vacuum-released parking brake that applies the brake shoes at the rear wheels through mechanical linkage.

The Fleetwood Eldorado is equipped with drum brakes similar in operation to those used on other 1967 Cadillac models; however, front wheel disc brakes are available as an extra cost option on the Fleetwood Eldorado only. For additional descriptive information concerning cars equipped with drum brakes, refer to the forward portion of this section.

Disc Brakes (Fig. 5-29)

The major components of the disc brake system are the hub and disc assembly, the caliper assembly, the metering valve, the proportioning valve and the distributor and switch assembly. In addition, a different master cylinder is used.

a. Hub and Disc Assembly

The cast iron disc is of the fully ventilated type, with 40 cooling fins cast integrally between the machined braking surfaces. When the wheel is in motion, the rotation of the disc fins increases the air circulation for more efficient cooling of the unit.

The disc is protected from cross-car by a splash shield on the inboard side.

b. Caliper Assembly

The caliper assembly is fixed to the steering knuckle and straddles the outside diameter of the disc so that on brake application the brake shoes and linings exert a ''clamping'' action on the disc.

The caliper assembly consists of an inboard and outboard housing bolted together. Each housing contains two cylinder bores positioned so that they are directly opposite the corresponding cylinder bores on the other housing. Each cylinder bore contains a piston and square cut seal. The seal is located within a canted groove machined in each cylinder bore. It provides the hydraulic seal between the piston and cylinder wall, and also provides the automatic adjustment of clearance between the brake shoes and disc after each application.

A molded rubber dust boot held in place by a groove in the cylinder wall and a groove in the piston provides protection from contamination for the piston and cylinder walls.

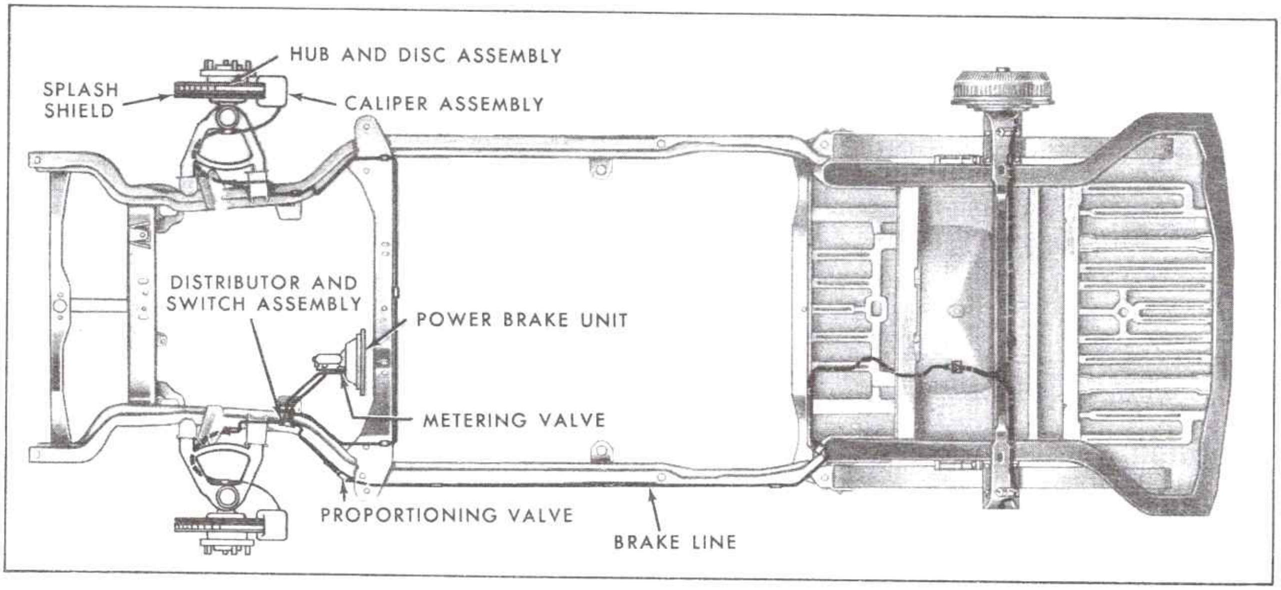


Fig. 5-29 Location of Disc Brake Components

c. Metering Valve

The metering valve is located on the power brake unit and is installed in the hydraulic line to the disc brake calipers. The purpose of the metering valve is to delay the application of the disc brakes until such time as the pressure to the rear brakes builds up sufficiently to overcome the rear brake shoes retracting springs, to provide a balanced brake system.

d. Proportioning Valve

The proportioning valve, located on the left side rail of the frame, is installed in the hydraulic line to the rear brake wheel cylinders. As disc brakes require higher line pressures for full application, the proportioning valve serves to limit the fluid pressure to the rear wheel cylinders on hard pedal application, minimizing the possibility of rear wheel skid.

e. Distributor and Switch Assembly

The distributor and switch assembly, installed in the hydraulic line between the master cylinder and the front and rear brake system, performs two functions. First, it serves to measure the difference between the hydraulic pressures to the two halves of the brake system. If a pressure differential greater than 175 psi exists between the halves of the system, it is indicative of a fluid leak in one half of the system, and the BRAKE light, located on the left side of the instrument cluster, is energized.

The second function of this assembly is to distribute the brake fluid to the right and left caliper assemblies.

f. Master Cylinder

Two makes of master cylinders are used on the 1967 Fleetwood Eldorado, dependent on whether or not the car is equipped with disc brakes. The Delco Moraine unit is used on all 693 series cars without disc brakes, and the Bendix power brake unit is used on 693 series cars with disc brakes.

The master cylinder, Fig. 5-30, used on disc brake equipped cars has several features different from the master cylinders used on cars

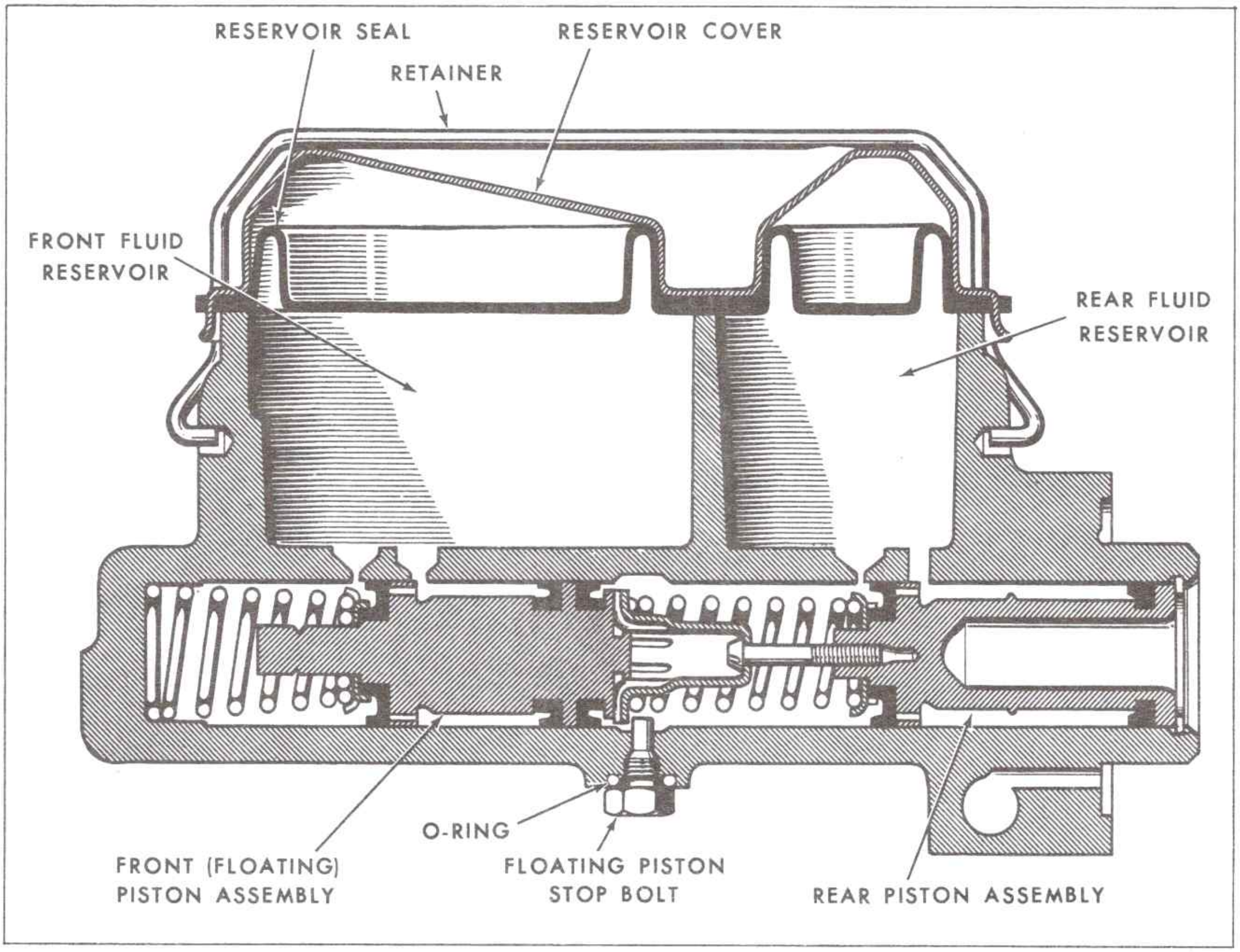


Fig. 5-30 Bendix Power Brake Unit (Disc Brake)

equipped with drum brakes. As disc brakes do not require that residual pressure be maintained in the brake lines, a residual check valve is not used in the master cylinder front outlet. A residual check valve is used, however, in the master cylinder rear outlet for the rear brake lines.

Another difference is that the master cylinder casting is larger than those used on drum brake cars, and that the front fluid reservoir is larger than the rear fluid reservoir. This design is required because of the greater fluid capacity inherent in a disc brake system.

Service procedures, however, are basically the same as for other master cylinders.

SERVICE INFORMATION

NOTE: The service information that follows pertains only to the Fleetwood Eldorado. For service procedures not given, refer to the forward portion of this section, as these procedures are the same as for the other 1967 Cadillac models.

22. Bleeding Brakes—Disc

For Fleetwood Eldorados equipped with drum brakes the bleeding procedure is described in Note 9.

CAUTION: Avoid use of any brake fluid that has a boiling point lower than 375°F on cars equipped with disc brakes. For cars so equipped, it is mandatory that a brake fluid equivalent to Delco Supreme Super 11 Heavy Duty Brake Fluid be used.

Do not spill brake fluid on car finish or damage will result.

a. Pressure Bleeder Method

1. Raise car and place on jack stands.

2. Remove front wheels.

CAUTION: During removal and installation of front wheels, care must be taken not to interfere with or damage the caliper shoe retainers, the bleeder screw or the crossover line.

3. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with fluid.

4. Install Bleeder Adapter Cover, J-22489-1, on master cylinder and connect bleeder hose to Bleeder Adapter Cover.

5. Build up pressure in bleeder.

6. Using a small piece of plastic, electrician's tape, tape metering valve push rod in a depressed position.

CAUTION: Do not secure metering valve push rod too tightly, as if pressure in system rises above approximately 100-130 psi, the valve will open, thereby pushing the stem downward.

7. Attach drain hose to bleeder fitting on right front caliper.

8. Back off fitting one half turn and bleed brake fluid into a partially filled bottle of clean brake fluid until bubbles stop, then close fitting.

9. Repeat operation for left caliper.

10. Install wheels, remove jack stands and lower car.

11. Remove tape from metering valve.

12. Before driving vehicle, be sure a firm pedal is obtained.

b. Alternate Method

When bleeding disc brake systems without the aid of a pressure bleeder, more pedal pumping is required during the bleeding procedure than with drum brakes, and the fluid level in the master cylinder reservoirs should be frequently checked.

1. Raise car and place on jack stands.

2. Remove front wheels.

3. Perform steps outlined in Note 9b, bleeding the brakes in the following order, right rear, left rear, right front and left front.

NOTE: Bleed rear brakes only if necessary.

4. Install wheels, remove jack stands and lower car.

CAUTION: During removal and installation of front wheels, care must be taken not to interfere with or damage the caliper shoe retainers, the bleeder screw or the crossover line.

5. Before driving vehicle, be sure a firm pedal is obtained.

23. Relining Brakes

a. Front Brakes (Drum) Fig. 5-31

1. Raise car and remove front wheels and drums.

CAUTION: When handling brake drums, be extremely careful not to drop the drum, or get brake fluid or grease on frictional surface.

NOTE: If brake drum is difficult to remove due to brake lining engagement, shear off head of secondary shoe hold-down pin at backing plate. Then, using screwdriver back off star wheel adjuster.

2. Remove retracting springs, using Brake Spring Remover and Installer, J-8049.

3. Remove primary brake shoe hold-down cup, spring, washer and pin, and secondary brake shoe hold-down cup, spring, pin and sleeve.

4. Remove link, pivot, pawl and override spring as an assembly, and remove pawl return spring.

5. Disengage brake shoes from wheel cylinder connecting links and remove shoe and lining assemblies from brake backing plate.

6. Remove star wheel adjuster and primary-to-secondary connecting spring from shoe assemblies.

7. Clean brake backing plate and all brake parts.

CAUTION: To avoid the possibility of brake "grab" or "pull" after brake service has been performed, make certain that hands are clean when handling brake parts and avoid handling friction surfaces of drums and linings.

8. Tighten front backing plate to steering knuckle bolts to 65 foot-pounds.

9. Lubricate threads and sockets of star wheel adjuster and points of contact between brake shoes and other brake parts with special heat resistant lubricant, available from servicing Parts Warehouses. Use sparingly, especially on brake shoe pads.

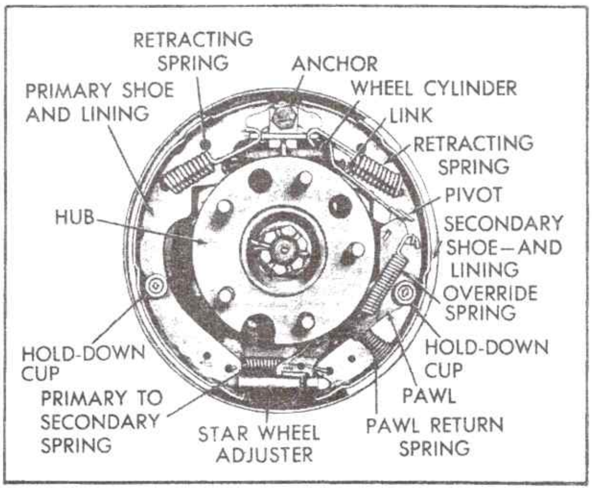


Fig. 5-31 Front Wheel Brake Mechanism (Left Side)

10. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

11. Install star wheel adjuster and primary-to-secondary connecting spring on replacement brake shoes.

NOTE: Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand thread) are installed on right side of car, while those with three narrow grooves (right hand thread) must be installed on left side of car. Incorrect installation of star wheel pivot nuts will result in automatic adjusters loosening rather than tightening brakes.

12. Position shoe assemblies on brake backing plate so that shoes engage wheel cylinder connecting links.

13. Install pin, washer, spring (green) and hold-down cup retaining primary shoe to backing plate.

14. Position pivot, pawl and override spring, as an assembly on secondary shoe.

15. Install link and pawl return spring and secure all parts in place by installing hold-down sleeve.

16. Install pin, spring (maroon) and hold-down cup retaining secondary brake shoe to backing plate.

17. Install primary and secondary brake shoe retracting springs, using Brake Spring Remover and Installer, J-8049.

18. Wipe steering knuckle clean and apply a thin film of wheel bearing grease on spindle.

CAUTION: Do not let any grease or oil get on drums or linings.

19. Install front brake drums, after adjusting star wheel adjuster so that drums just fit over linings.

20. Install wheels and lower car. Final adjustment is obtained by alternately driving car back and forth and applying brakes.

b. Front Brakes (Disc)

1. Raise front of car and place on jack stands.

2. Remove front wheels.

Fig. 5-32 Relining Disc Brakes

CAUTION: During removal and installation of front wheels, care must be taken not to interfere with or damage the caliper shoe retainers, the bleeder screw or the crossover line.

3. Remove two screws securing caliper shoe retainers to caliper and remove shoe retainers.

4. Pushing on shoe assemblies, force pistons back into their bores.

5. Using pliers, grasp the tabs on the outer end of the shoe and remove the shoe and lining assembly by pulling straight out, Fig. 5-32.

6. Remove the other shoe assembly in the same manner.

NOTE: Carefully inspect pistons and dust boots for any evidence of damage or leakage. If there is any indication of damage to either boots or pistons, or excessive leakage, the caliper assembly must be overhauled as described in Note 27.

7. Make certain that all pistons are fully seated.

8. Slide a new shoe and lining assembly with lining facing disc into the caliper on each side of the disc, so that the tabs of each shoe rest on the bridge of the caliper.

9. Position caliper shoe retainers to caliper and install two retaining screws, tightening screws to 8 foot-pounds.

10. Repeat steps 3 through 9 for caliper unit on opposite side of car.

11. Pump brake pedal several times until a firm pedal is obtained.

12. Install wheels, remove jack stands and lower car.

CAUTION: During removal and installation of front wheels, care must be taken not to interfere with or damage the caliper shoe retainers, the bleeder screw or the crossover line.

13. Tighten wheel mounting nuts to 105 foot-pounds.

14. Break in new linings as described in Note 6.

c. Rear Brakes Fig. 5-33

1. Release parking brake, raise car, and remove rear wheels and drums.

CAUTION: When handling brake drums, be extremely careful not to drop the drum or get brake fluid or grease on frictional surface.

2. Loosen parking brake cable locknut at equalizer.

3. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.

4. Disconnect link at anchor, using Brake Spring Remover and Installer, J-8049, and remove link, secondary brake shoe retracting spring, and anchor plate.

5. Remove primary brake shoe hold-down cup, spring, washer and pin, and secondary brake shoe hold-down cup, spring, pin and sleeve.

6. Remove pivot pawl and override spring as an assembly, and remove pawl return spring.

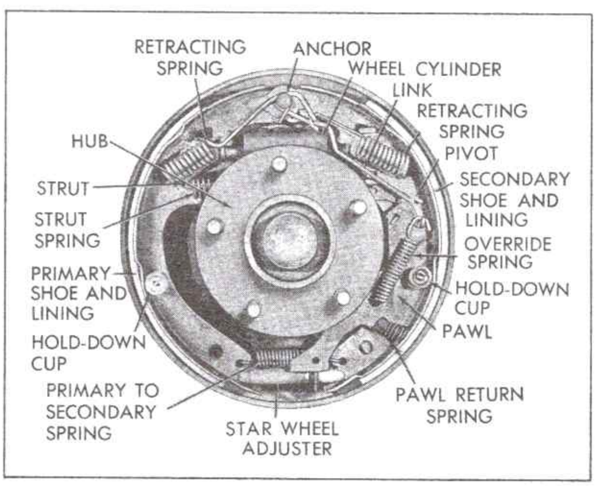


Fig. 5-33 Rear Wheel Brake Mechanism (Left Side)

7. Spread brake shoes and remove parking brake strut rod and spring.

8. Remove parking brake operating lever from secondary brake shoe and remove shoe and lining assemblies from brake backing plate.

9. Remove star wheel adjuster and primary-to-secondary connecting spring from brake shoes.

10. Clean brake backing plate and all brake parts.

> CAUTION: To avoid the possibility of brake "grab" and "pull", make certain that hands are clean when handling brake parts. Avoid handling friction surfaces of drums and linings.

11. Torque nuts that hold backing plate to rear spindle to 40 foot-pounds.

12. Lubricate threads and socket of star wheel adjuster and points of contact between brake shoes and other brake parts with special heat resistant lubricant, available from servicing Parts Warehouses. Use sparingly, especially on brake shoe pads.

13. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

14. Install star wheel adjuster and primary-to-secondary connecting spring on replacement brake shoes.

> NOTE: Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand thread) are installed on right side of car, while those with three narrow grooves (right hand thread) on O.D. of pivot nut are installed on left side of car. Incorrect installation of star wheel pivot nuts will result in automatic adjusters loosening rather than tightening brakes.

15. Install parking brake operating lever on secondary brake shoe and position shoe and lining assemblies to brake backing plate.

16. Install parking brake strut rod and spring on brake shoes.

> NOTE: Strut rod offset is positioned inboard and spring is positioned against primary brake shoe with spring tab outside of brake shoe web.

17. Engage brake shoes with wheel cylinder connecting links and install primary brake shoe hold-down pin, washer, spring (green) and cup.

18. Install anchor plate and position pivot, pawl and override spring as an assembly to secondary brake shoe.

19. Install link and pawl return spring and secure all parts to secondary brake shoe by installing hold-down sleeve.

20. Install secondary brake shoe hold-down pin, spring (maroon) and cup.

21. Install primary brake shoe retracting spring (grey) using Brake Spring Remover and Installer, J-8049.

22. Install secondary brake shoe retracting spring (blue) using Brake Spring Remover and Installer, J-8049.

23. Install rear brake drums.

24. Perform manual service brake adjustment.

25. Adjust parking brake as described in Note 2.

26. Install rear wheels and lower car.

24. Wheel Cylinder Removal, Disassembly and Cleaning (Drum Brakes)

a. Removal

1. Raise car and remove wheel and brake drum. Blow out dust and dirt from drum and backing plate, being careful not to blow dirt into wheel bearing area.

2. Disconnect hydraulic brake hose or piping from wheel cylinder.

> CAUTION: If wheel cylinder is on either front wheel, it is necessary to remove hydraulic brake hose, as described in Note 30a, before disconnecting from wheel cylinder.

3. If removing front wheel cylinder, remove retracting springs and link.

4. If removing rear wheel cylinder, remove override spring, link and retracting springs.

5. Remove two screws and lockwashers securing wheel cylinder to backing plate.

6. Disengage wheel cylinder connecting links from brake shoes and remove wheel cylinder.

> CAUTION: Be sure brake fluid does not drip on brake linings.

b. Disassembly and Cleaning

The procedure for disassembly and cleaning of the wheel cylinder is described in Notes 7b and 7c, respectively.

25. Wheel Cylinder Assembly and Installation (Drum Brakes)

a. Assembly

The procedure for assembly of the wheel cylinder is described in Note 8a.

b. Installation

1. Position wheel cylinder to brake backing plate, slipping cylinder-to-shoe connecting links in place at same time.

2. Install two screws and lockwashers securing wheel cylinder to backing plate. Tighten to 15 foot-pounds.

3. If rear wheel cylinder is being installed, install link, override spring and retracting spring.

4. If front wheel cylinder is being installed, install link and retracting springs.

5. Install hydraulic brake hose on front wheel as described in Note 11b, or connect brake piping to rear wheel.

6. Install brake drum and wheel assembly.

7. Bleed all brakes as described in Note 9.

8. Lower car.

26. Disc Brake Caliper

a. Removal

1. Raise front of car and place on jack stands.

2. Remove front wheel.

CAUTION: During removal and installation of front wheels, care must be taken not to interfere with or damage the caliper shoe retainers, the bleeder screw or the crossover line.

3. Disconnect brake line at caliper inlet fitting.

4. Remove two bolts securing caliper assembly to steering knuckle and remove caliper assembly by sliding it up and away from the disc.

b. Installation

NOTE: Before installing the caliper on the brake disc, check the disc for lateral run-out using a dial indicator. If lateral runout exceeds .002 inch, the hub, disc wheel bearing and bearing retainer are to be replaced as an assembly.

1. Make certain that all pistons are fully seated in their bores and that the shoe and lining assemblies are positioned against their respective pistons so that when installed over the disc the linings will face the disc.

2. Position caliper assembly over brake disc, aligning caliper mounting holes with bolt holes in steering knuckle.

3. Install two bolts and washers securing caliper assembly to steering knuckle, tightening bolts to 95 foot-pounds.

4. Connect brake pipe to inlet fitting on caliper, tightening to 25 foot-pounds.

5. Bleed brakes as described in Note 22.

CAUTION: When bleeding disc brakes, the metering valve push rod must be depressed manually to assure that the brake fluid will pass through the metering valve.

6. Pump brakes several times to actuate the piston seals and seat linings.

7. Install wheels, remove jack stands and lower car.

CAUTION: During removal and installation of front wheels, care must be taken not to interfere with or damage the caliper shoe retainers, the bleeder screw or the crossover line.

8. Tighten wheel mounting nuts to 105 foot-pounds.

27. Disc Brake Caliper Disassembly, Cleaning, Inspection and Assembly

a. Disassembly

NOTE: The inboard and outboard caliper halves should not be separated.

1. Remove caliper unit from car as described in Note 26a.

2. Remove crossover line by disconnecting fittings from inboard and outboard caliper halves.

3. Remove two screws securing caliper shoe retainers to caliper bridge and remove retainer assembly.

4. Remove shoe and lining assemblies.

NOTE: Piston removal can be facilitated through the construction of a 2-5/8 inch square seal plate of 1/16 inch stock, with gasket material cemented on one side.

5. Position a 3 x 4-1/2 x 3/4 inch piece of soft wood inside of caliper bridge area, between pistons, Fig. 5-34.

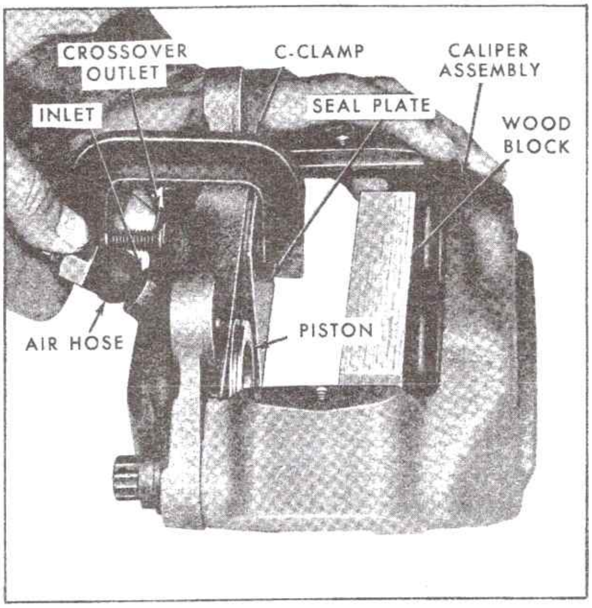


Fig. 5-34 Removing Pistons from Caliper

6. Seal crossover outlet on inboard half of caliper with thumb and, using service air hose, apply moderate air pressure to brake fluid inlet hole to force one piston out of inboard half of caliper.

7. Position seal plate or similar device over bore of piston previously removed, retaining with a C-clamp, and repeat step 6 to force remaining piston from inboard half of caliper assembly, Fig. 5-34.

8. Apply air pressure through crossover inlet on outboard half of caliper assembly, forcing one piston out of outboard half of caliper.

9. Position seal plate or similar device over bore of piston previously removed, retaining with a C-clamp and repeat step 8 to force remaining piston from outboard half of caliper assembly.

10. Remove and discard piston dust boots from caliper assembly.

11. Using a plastic toothpick, remove piston seal from groove in each piston bore in caliper housings.

CAUTION: Do not use any metallic device to remove the seals, as they may scratch or damage the bores of the housing.

12. Remove bleeder fitting from outboard half of caliper assembly.

b. Cleaning and Inspection

1. Clean all parts with brake fluid and wipe dry using a clean, lint-free cloth. Using an air hose, blow out bores and passages in caliper housings.

2. Inspect piston bores in caliper housings for corrosion, scoring, pitting or other damage. Bores which show minor imperfections can usually be cleaned up with crocus cloth. However, bores that have deep scratches or scoring cannot be serviced and are to be replaced as an assembly.

NOTE: Black stains on the bore walls are caused by the piston seals and are not harmful.

3. Check the piston seal and dust boot grooves in the bores for damage.

4. Check each piston for pitting and scoring or if the chrome plating is worn off, if any of these conditions exist, the piston is to be replaced.

c. Assembly

NOTE: When reassembling caliper assembly, use only the special lubricant provided with the service repair kit as assembly fluid. The use of brake fluid as an assembly fluid is not recommended.

1. Position caliper assembly in vise, clamping on inboard housing with bores up, and install bleeder fitting in outboard caliper housing.

2. Lubricate bores in inboard housing with special lubricant.

3. Lubricate piston seal with special lubricant and install seal in second groove in housing bore, Fig. 5-35.

4. Lubricate lips of dust boot with special lubricant and install dust boot in upper groove of

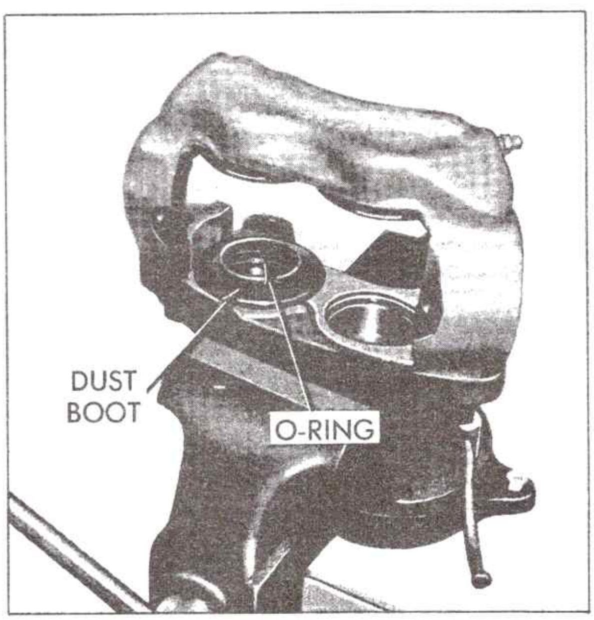


Fig. 5-35 Installing Dust Boot

Fig. 5-36 Installing Piston in Dust Boot

housing bore, making certain that dust boot is properly seated in bore groove, Fig. 5-35.

5. Lubricate piston with special lubricant and start piston inside of dust boot, Fig. 5-36.

6. With thumb and forefinger, compress dust boot against piston and work dust boot around piston until piston is installed in dust boot, Fig. 5-37.

7. Repositioning piston as necessary, slowly force piston into caliper bore; as piston moves downward, dust boot lip will seat in groove on piston.

NOTE: When piston is fully seated, trapped air under dust boot may cause dust boot lip to disengage from piston groove. If this occurs, reinstall lip of dust boot in piston groove using thumbnail.

8. Repeat steps 2-7 to install second piston in inboard housing.

9. Invert caliper assembly in vise and repeat piston installation procedures, steps 2-7, for pistons to be installed in outboard half.

10. Remove caliper assembly from vise, and install shoe and lining assemblies into caliper bridge area so that shoes rest against their respective pistons.

11. Position shoe retainers to caliper unit, and retain with two screws. Tighten screws to 8 foot-pounds.

12. Install crossover line to caliper housings, tightening fittings to 25 foot-pounds.

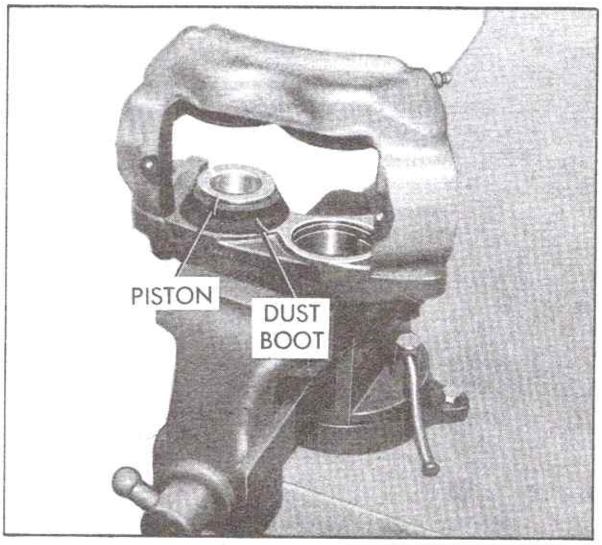


Fig. 5-37 Piston Installed in Dust Boot

13. Install caliper housing as described in Note 26b.

28. Hub and Disc Assembly

The procedure for removing and installing the hub and disc assembly is described in Section 3, Note 19.

29. Servicing Discs

The hub and disc assemblies should be carefully checked to see that they are within specifications and that they have not become scored excessively.

In manufacture, the hub and disc are machined as a unit, and must be replaced as an assembly in the field. In manufacturing, the disc tolerance for flatness and parallelism of the frictional surfaces is held to .0005 inch, while lateral runout of the disc surfaces cannot exceed .002 inch total indicator reading. Further, the finish of the frictional surfaces must be maintained to 30-50 micro-inches.

In view of the foregoing specifications, machining of the disc in the field is not recommended. However, once a wear pattern has been established, disc brake cars are not as susceptible to problems occurring because of scored discs, as drum brake cars are due to scored drums. Therefore, discs should be replaced on a selective basis to solve a brake malfunction.

In use, a slight ridge of rust is liable to form on the edge of the disc; this can be removed with crocus cloth.

30. Proportioning Valve

NOTE: The proportioning valve is a non-adjustable, non-serviceable valve. If defective it must be replaced.

a. Removal

1. Disconnect brake lines from proportioning valve.

2. Remove screw securing proportioning valve mounting clip to left frame side rail and remove proportioning valve.

b. Installation

1. Position proportioning valve to brake lines, and loosely start tube nuts into proportioning valve.

2. Install mounting bracket and screw retaining proportioning valve to frame side rail.

3. Tighten brake line tube nuts to 15 foot-pounds.

4. Bleed brakes as described in Note 9.

31. Metering Valve

NOTE: The metering valve is a non-adjustable, non-serviceable valve. If defective it must be replaced.

a. Removal

1. Disconnect brake lines from metering valve.

2. Remove master cylinder to power heat nut securing metering valve mounting bracket to power head stud and remove metering valve.

b. Installation

1. Install metering valve and mounting bracket on power head stud and loosely install nut and lockwasher securing bracket to power head.

2. Start brake line tube nuts into metering valve.

NOTE: Metering valve inlet port is identified by the letter "M" and outlet port by the letter "F."

3. Tighten master cylinder to power head nut to 20 foot-pounds.

4. Tighten brake line tube nuts to 15 foot-pounds.

5. Bleed brakes as described in Note 22.

32. Distributor and Switch Assembly

NOTE: The distributor and switch assembly is non-adjustable and non-serviceable. If defective it must be replaced.

a. Removal

1. Disconnect electrical lead from terminal on assembly.

2. Disconnect brake lines from distributor and switch assembly.

3. Remove bolt securing mounting bracket to frame and remove assembly with mounting bracket attached.

b. Installation

1. Position distributor and switch assembly with mounting bracket attached to frame and loosely install retaining screw.

2. Start all brake line tube nuts into their respective holes in distributor and switch assembly.

3. Tighten screw securing assembly to frame.

4. Tighten brake line tube nuts to 15 foot-pounds.

5. Bleed brakes as described in Note 22.

33. Servicing Hydraulic Brake Hoses and Piping

a. Removal—Hydraulic Brake Hose (Front Wheels—Drum Brakes)

1. Disconnect steel brake line from hose by turning steel tube fitting out of hose fitting. Cap fitting to prevent dirt from entering brake line.

2. Remove U-shaped retainer from hose fitting at frame support bracket and remove hose from bracket.

3. Remove cotter pin and nut securing upper ball joint to knuckle and remove clip securing brake hose to ball joint stud.

4. If right front hose is being replaced, remove clip retaining hose to frame.

5. Turn hose fitting out of wheel cylinder inlet and remove and discard copper gasket. If hose is to be reused, cap end fittings to prevent dirt from entering hose.

b. Installation—Hydraulic Brake Hose (Front Wheels—Drum Brakes)

1. Install new copper gasket on wheel cylinder end of hose (male end).

2. Tighten hose in wheel cylinder inlet to 25 foot-pounds.

CAUTION: Never tighten hose in wheel cylinder inlet with hose attached at frame end, as this will twist the hose.

3. Install brake hose clip on upper ball joint stud and install ball joint retaining nut on stud. Tighten ball joint nut finger tight.

4. With suspension in normal position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in the position that will result in least twisting of hose.

NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension, steering and driving parts.

5. Install U-shaped retainer to secure hose to frame support bracket.

6. Inspect by turning wheels from stop-to-stop while observing hose position. Be sure that hose does not touch any other part at any time during steering travel. If contact does occur, remove hose retainer, and if necessary loosen upper ball joint nut, and reposition hose as necessary. Replace retainer, tighten ball joint nut finger tight, and reinspect.

7. When hose is properly positioned, torque ball joint nut to 60 foot-pounds.

8. If right front hose is being replaced, install clip securing hose to frame.

9. Install steel brake line fitting into brake hose at frame support bracket and tighten fitting to 25 foot-pounds, being careful to avoid damaging threads.

10. Bleed brakes as described in Note 9.

c. Removal—Hydraulic Brake Piping (Rear Wheels)

1. Disconnect steel brake piping at rear wheel cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.

2. Disconnect brake piping at brake line junction fitting on rear axle.

3. If left brake piping is being removed, remove one spring clip retaining piping to rear axle and remove piping.

4. If right brake piping is being removed, remove three clips, two spring and one bolted, and remove piping.

d. Installation—Hydraulic Brake Piping (Rear Wheels)

1. Position brake piping to rear axle.

a. If right brake piping is being installed, install three clips, two spring and one bolted, retaining piping to rear axle.

b. If left brake piping is being installed, install one spring clip retaining piping to rear axle.

NOTE: Use new spring clips when securing piping to rear axle.

2. Connect piping to brake line junction fitting on rear axle, tightening to 15 foot-pounds.

3. Connect brake piping to rear wheel cylinder fitting, tightening fitting to 20 foot-pounds.

4. Bleed all brakes as described in Note 9.

34. Parking Brake Cables

a. Front Cable

The procedure for removing and installing the front parking brake cable is described in Note 15a and 15b respectively.

b. Removal—Rear Cable

1. Release parking brake.

2. Raise rear of car and position on jack stands.

3. Remove rear wheels and drums.

4. Remove rear equalizer nut and separate equalizer from front cable.

5. Pry open ears on equalizer and remove cable from equalizer.

6. Remove U-shaped clips retaining parking brake cable to underbody brackets on right and left sides.

7. Remove wire guides retaining brake cable to rear axle at center spring clamp.

8. Remove cable ends from parking brake operating levers, and remove cable ends from backing plates.

c. Installation—Rear Cable

1. Install cable ends through backing plates and connect to parking brake operating levers.

CAUTION: Pull on center of cable and check operation of cable and brake mechanisms.

2. Routing cable toward center of car, install wire guides retaining cable to rear axle at center spring clamp.

3. Position brake cable to underbody brackets on right and left sides of car, and secure with U-shaped clip.

4. Install cable in equalizer and bend equalizer ears over cable. Brush small amount of lubricant in equalizer slot.

5. Insert front cable stud through equalizer hole, and install rear equalizer nut.

6. Install rear drums and wheels.

7. Adjust parking brake as described in Note 2.

35. Parking Brake Assembly

a. Removal

1. Release parking brake and place transmission shift lever in Park position.

2. Working underneath car, remove equalizer nut and separate front cable stud from equalizer.

3. Working in engine compartment, remove two nuts securing parking brake assembly to cowl.

4. Remove steering column lower cover as described in Section 12, Note 38a.

5. Position carpet and left cowl kick-pad out of the way.

6. Disconnect vacuum hose from parking brake cylinder.

7. Remove two bolts retaining parking brake assembly to instrument panel.

8. Moving assembly away from cowl, position assembly so that clevis is exposed and remove cable end from clevis.

b. Installation

1. Position parking brake assembly so that clevis is exposed and attach parking brake cable end to clevis.

2. Position parking brake assembly to cowl and, from engine compartment, install two nuts retaining assembly to cowl.

3. Install two bolts retaining parking brake assembly to instrument panel.

4. Connect vacuum hose to parking brake vacuum cylinder.

5. Replace cowl kick-pad and carpet.

6. Insert front cable stud through equalizer, making sure that rear cables are properly routed through equalizer and secured at C-shaped clamp, Fig. 5-10.

7. Install equalizer nut.

8. Adjust parking brake as described in Note 2.

9. Check operation of parking brake.

10. Install steering column lower cover as described in Section 12, Note 38b.

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	REMEDY
Excessive pedal travel	Excessive disc runout.	Check disc for runout with dial indicator.
	Air, or insufficient fluid, in system or caliper.	Bleed system, check for leaks and replenish fluid.
	Improper brake fluid (boil).	Drain, flush and install correct fluid.
	Rear brake adjustment required.	Check and adjust rear brakes.
	Warped or excessively tapered shoe and lining assembly.	Install new shoe and linings.
	Damaged caliper piston seal.	Install new piston seal.
	Master cylinder malfunction.	Check and correct master cylinder.
	Metering valve not compensating (noticeable on first brake application after car sits overnight).	Replace metering valve.
Brake roughness or chatter - pedal pumping	Excessive lateral runout of braking disc.	Check disc for lateral runout with dial indicator. Install new disc if runout of either face exceeds .002".
	Excessive out-of-parallelism of braking disc.	Check disc for out-of-parallelism with micrometer. Install new disc if out-of-parallelism exceeds .0005".
Excessive pedal effort	Master cylinder or power brake malfunction.	Check and correct as necessary.
	Shoe and lining worn.	Install new shoe and linings.
	Incorrect lining.	Remove lining and install correct lining.
	Frozen or seized pistons.	Disassemble caliper.
Pull	Lining surface contaminated or slightly charred from fast break-in.	Install new shoe and lining.

DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Pull (Cont'd.)	Frozen or seized pistons.	Disassemble caliper and repair.
	Damaged or worn caliper piston seal.	Disassemble caliper and install new seal.
	Scores or corrosion on surface of piston.	Disassemble caliper and clean if necessary. Install new pistons.
	Incorrect tire pressure.	Inflate tires to recommended pressures.
	Front end out of alignment.	Align front end and check.
	Restricted hose or line.	Check hoses and lines and correct as necessary.
	Unmatched linings.	Install correct linings.
Noise	Excessive clearance between the shoe and the caliper.	Install new shoe and lining assemblies.
	Shoe hold down anti-rattle retainer assembly missing or not properly positioned.	Install new anti-rattle retainer assembly or position properly.
	Braking disc rubbing caliper housing.	Check for rust or mud build-up on caliper housing adjacent to disc. Check caliper mounting and bridge bolt tightness.
Brake drag	Master cylinder not compensating.	Check and correct master cylinder.
	Sticking pedal linkage.	Free up sticking pedal linkage.
	Frozen or seized pistons.	Disassemble caliper, clean seal groove and install new pistons, seals and boots.
	Faulty metering valve.	Replace valve.
Grabbing or uneven braking action.	Power brake malfunction.	Check and correct power unit.
	Causes listed under "Pull".	Corrections listed under "Pull".
	Proportioning valve not functioning (rear wheels skid)	Replace proportioning valve.

DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Brake pedal can be depressed without braking effect	No fluid in reservoir.	Refill reservoir and check for cause of fluid depletion.
	Pistons pushed back in cylinder bores during servicing of caliper (shoe and lining not properly positioned).	Reposition the brake shoe and lining assemblies. Depress pedal a second time and if condition persists, check the following causes:
	Leak in system or caliper.	Check for leak and repair as required.
	Damaged piston seal in one or more of the cylinders.	Disassemble caliper and replace piston seals as required.
	Air in hydraulic system or improper bleeding procedure.	Bleed the system.
	Bleeder screw open.	Close bleeder screw and bleed the entire system.

SPECIFICATIONS

Item	693 Series Cars
Braking Area (in square inches)	
Front	
Drum	190
Disc	222
Rear	138
Lining Area (in square inches)	
Front	
Drum	132
Disc	40.8
Rear	96
Wheel Cylinder Bore	
Front	
Drum	1-1/8"
Disc	1-15/16"
Rear	7/8"
Drums (inside diameter)	11.00"
Remachined Drum Diameter (maximum)	11.06"
Variations of Inside Diameter (maximum)	
Front and Rear	.002"
Run-Out of Inside Diameter	.005"
Lateral Runout of Rotor	.002"
Flatness Between Frictional Surfaces of Rotor	.0005"
Lining Size (length, width, thickness in inches)	
Front	
Primary	12.00 x 2.75 x .20
Secondary	12.00 x 2.75 x .29
Disc	5.34 x 1.9 x .43
Rear	
Primary	12.00 x 2.00 x .20
Secondary	12.00 x 2.00 x .29
Lining to Shoe Attachment Method	Rivets
Metering Valve	
Minimum	100 psi
Maximum	130 psi
Blend Point	380 psi
Proportioning Valve	43% above 400 psi

TORQUE SPECIFICATIONS

Material Number	Application	Size	Foot-Pounds
300M	Caliper-to-Steering Knuckle Bolt	1/2-13	95
280M	Splash Shield-to-Steering Knuckle Screw	1/4-20	8
280M	Retainer-to-Caliper Screw.	1/4-20	8
Special	Pipe Nuts to Proportioning Valve	7/16-20 1/2-20	15
Special	Pipe Nuts to Metering Valve.	3/8-24	15
Special	Pipe Nuts to Caliper	3/8-24	20
Special	Pipe Nuts to Wheel Cylinder	3/8-24	20
Special	Pipe Nuts to Distributor and Switch Assembly .	3/8-24 7/16-24 1/2-20	15

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GENERAL DESCRIPTION

The cooling system of all 1967 Cadillac engines is of the low capacity type. This is made possible by the small cylinder head area exposed to combustion flame and the high mechanical and combustion efficiencies. With this design, the amount of heat developed in the engine is decreased and less coolant is required than with older type systems for necessary engine cooling.

A pressure relief radiator cap is used to raise the boiling point of the coolant and reduce the possibility of coolant loss. The pressure relief valve opens at 15 pounds per square inch.

A six-bladed fan and thermostatically-controlled clutch assembly is used on all air conditioned cars. When full use of the fan is not required for engine cooling, the clutch will partially uncouple the fan, limiting its maximum speed and reducing the fan noise level. These cars also use a two-piece fan shroud which is fastened to the radiator cradle.

The thermostatically-controlled fan clutch is serviced only as an assembly.

A seven-bladed fan and hub-spacer is used on all non-air conditioned cars, and on all commercial chassis.

A die-cast aluminum water pump is centrally mounted on the engine front cover. It is driven by "V" belts, which also drive the power steering pump, the generator, and the refrigerant compressor on air conditioned cars.

The water pump is serviced only as an assembly.

A thermo-vacuum valve is used on all 1967 697 series cars and on the Fleetwood Eldorado when equipped with air conditioning. The valve is located in the upper portion of the left radiator tank. It has three fittings, one to manifold vacuum, one to carburetor vacuum above the throttle valves and one to the distributor vacuum diaphragm. At coolant temperatures above 230°, this valve switches from carburetor vacuum to manifold vacuum, advancing the ignition timing to full vacuum advance at idle. This reduces the possibility of engine overheating under extremely high temperature operation. Also, the idle speed is raised slightly by this advance in the spark. This system functions at idle when manifold vacuum is high.

Coolant is pumped to each bank of cylinders simultaneously, then through drilled holes to the cylinder heads, through the thermostat housing at the top of the cylinder head water outlet pipe to the left hand radiator tank. Radiator coolant flow is from the left hand tank through the core to the

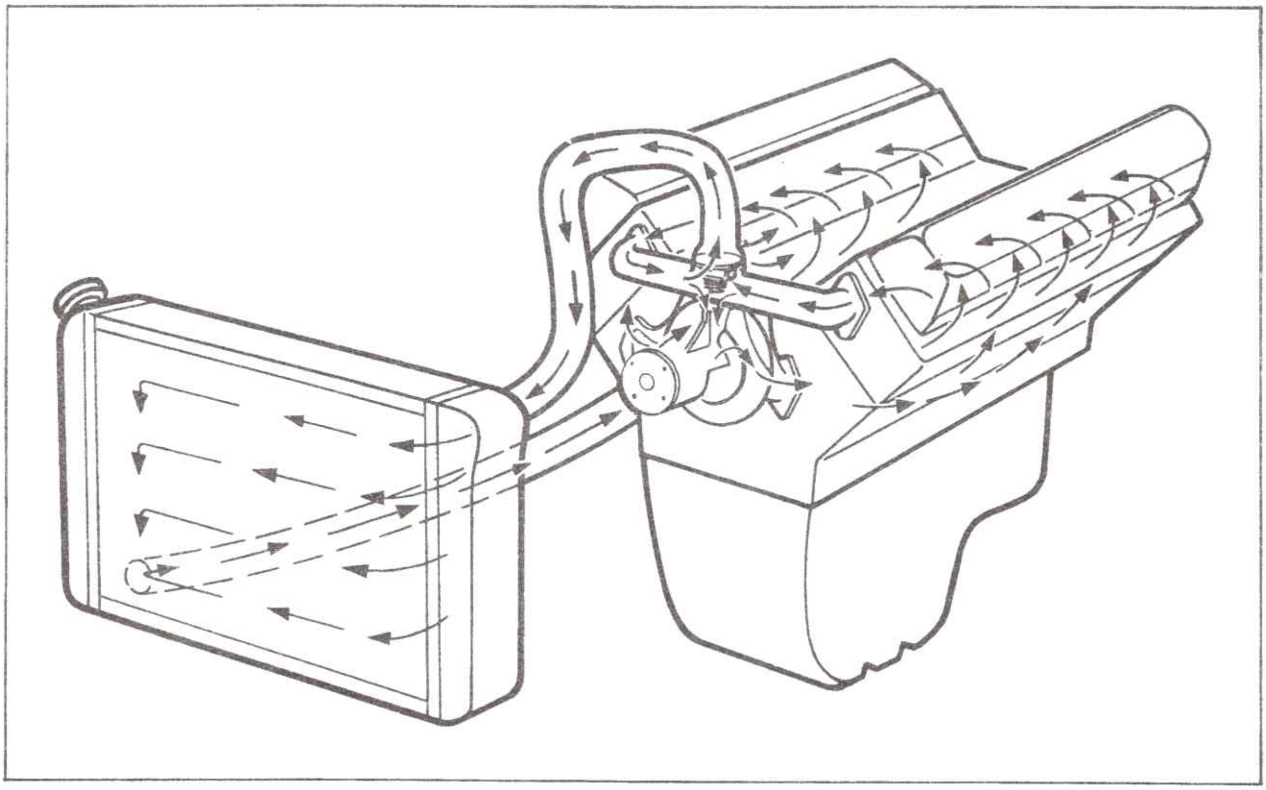


Fig. 6-1 Flow of Coolant

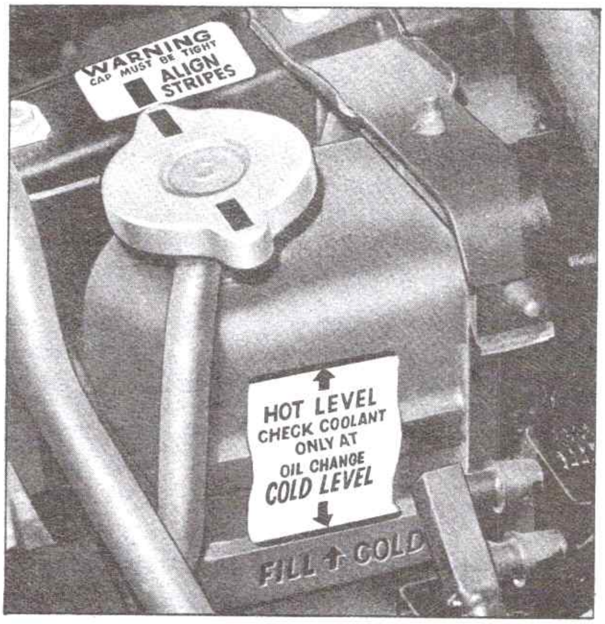


Fig. 6-2 Radiator Coolant Fill Levels

right hand tank which is used as the source of coolant to the water pump inlet. Fig. 6-1.

When the thermostat is closed, coolant from the cylinder heads is pumped through a by-pass passage in the cylinder head water outlet pipe back to the water pump and recirculated. When the engine is sufficiently warm, the thermostat opens and coolant flows to the inlet tank on the left side of the radiator, and is cooled as it flows across the horizontal core tubes to the outlet tank on the right side of the radiator, completing the cycle.

The transmission oil cooler is located in the outlet tank on the right side of the radiator.

1. Cooling System Preventive Maintenance

Regardless of climate, the cooling system should be drained, flushed with water only, and refilled every 24 months with water and an ethylene glycol base coolant to protect the engine to at least -20°F. Check all hose connections and add additional inhibitor and sealer every fall after the car has been run 24,000 miles or 24 months and whenever ethylene glycol base coolant is changed. These measures are necessary to retard corrosion, rust and scale, keep water passages open, and seal against internal or external leakage.

Check coolant level at each engine oil change. Coolant level with engine cold, at room temperature, should be 3 inches below bottom of filler neck. Coolant level with engine hot, at normal operating temperature, should be 1 inch below bottom of filler neck. Proper levels are shown on label below radiator filler cap. See Fig. 6-2. Do not overfill.

2. Testing Coolant Solutions

A hydrometer test will indicate whether ethylene glycol or water, or both, should be added to maintain the desired freezing point of the solution. The freezing point of the solution should give protection to -20°F, regardless of climatic conditions. This is necessary to provide adequate corrosion protection.

Some devices used for testing solutions will indicate the correct freezing point only when tested at a specific temperature. Other testers, provided with thermometers and tables, indicate freezing points corresponding to readings made at various temperatures. Disregarding the temperature of the solution when testing may cause an error as large as 30°F in determining the freezing point.

3. Thermostat Test

The thermostat may be checked by suspending it, with the thermostat heat control unit down, in a small pan of ethylene glycol coolant containing a thermometer. Neither the thermostat nor the thermometer should rest on the bottom of the pan because of the uneven concentration of heat at this point when the pan is heated. The thermostat valve should start to open at a temperature on air conditioned cars between 177°F. and 182°F. and between 192°F. and 197°F. on non-air conditioned cars. When the water reaches a temperature of 202°F. on air conditioned cars, or 217°F. on non-air conditioned cars, the valve should be fully open (approximately 29/64 inch).

4. Cooling System Flushing Procedure

1. Drain coolant from cooling system by opening radiator drain cock and removing two drain plugs from cylinder block. If coolant side of radiator cap is rusty, flush system twice.

2. After the drain points have been closed, refill system with fresh water only, install radiator cap, and set defroster lever to ICE position. This opens the water control valve and allows the water to pass through the heater core.

NOTE: On Fleetwood Seventy-Five sedans and limousines, also turn rear heater system on and rotate temperature dial to 85°.

3. Run engine at medium speed for one-half hour at a temperature as hot as possible without boiling. Cover one-half the radiator if necessary.

4. Inspect the following points in the cooling system:

a. Radiator core for leaks.

b. Radiator air passages for plugging caused by bugs, leaves, etc.

c. Condition and tension of drive belts.

d. Condition of hoses and tightness of clamps.

5. Drain system by opening all drains. If flush water has a rust color, repeat procedure.

6. After the drain points have been closed, add the required amount of ethylene glycol base coolant with water to protect engine to at least -20°F. Also use inhibitor and sealer regardless of whether or not the coolant used contains an inhibitor.

7. Place radiator cap in vent position. With all heater controls on maximum as outlined in step 2, run engine with throttle set on fast idle cam for 10 minutes. Stop engine and check coolant level. Add coolant if necessary to bring level to 1" below radiator cap seat.

5. Thermostat

a. Removal

1. Drain radiator until coolant level is below level of thermostat housing.

2. Disconnect upper radiator hose at thermostat housing.

3. Remove two cap screws that hold thermostat housing to cylinder head water outlet pipe and remove housing. Discard gasket.

4. Remove thermostat from top of cylinder head water outlet pipe.

b. Installation

1. Install thermostat in opening at top of cylinder head water outlet pipe, with valve up.

2. Position a new thermostat housing gasket coated with gasket cement on water outlet pipe.

3. Install thermostat housing on water outlet pipe and secure with two attaching screws. Tighten screws to 10 foot-pounds.

4. Connect upper radiator hose on thermostat housing.

5. Fill cooling system to proper level.

6. Fan Blade and Clutch Assembly Removal and Installation on Air Conditioned Cars (Fig. 6-3)

a. Removal

1. Remove 4 screws that hold fan blade to clutch.

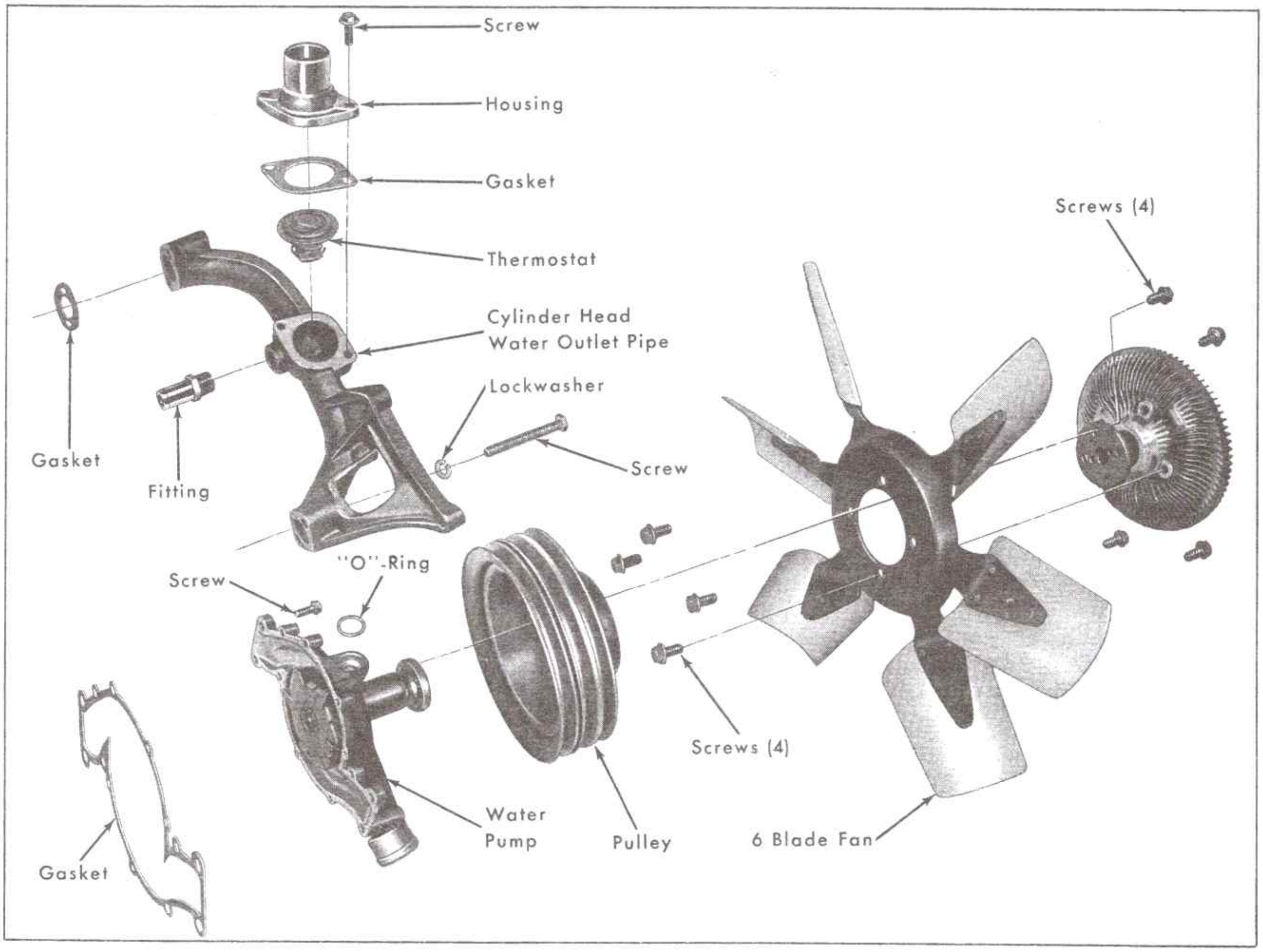


Fig. 6-3 Water Pump and Fan Components

2. Remove 4 screws holding clutch hub to water pump pulley. Remove fan blade and clutch assembly from car.

NOTE: Fan clutches used on air conditioned cars are always to be in an "in car position." When removed from car for any service procedure, support assembly to keep clutch disc in a vertical plane to prevent leaks of silicone fluid from clutch mechanism.

b. Installation

1. Attach clutch and fan assembly to water pump pulley with four screws.

2. Attach fan blade to clutch with four screws.

Removal and Installation on Non-Air Conditioned Cars

a. Removal

1. Remove two top screws holding radiator and tilt radiator forward. Brace with small block of wood.

2. Loosen fan screws holding fan and spacer to water pump pulley. Remove fan blade, spacer and fan bolts as unit.

b. Installation

1. Insert fan screws through fan and fan spacer and attach to water pump pulley.

2. Remove block of wood holding radiator and replace two attaching screws to radiator frame.

7. Water Pump Assembly

a. Removal

1. Disconnect negative battery cable.

2. Open radiator drain cock and drain coolant. Remove radiator fill cap so coolant will flow freely.

NOTE: To save coolant, remove radiator filler overflow hose and connect to radiator drain cock.

3. On Air Conditioned cars, except 693, partially disconnect compressor as described in Section 1, Note 31a. On Air Conditioned 693 cars, see Section 1, Note 91a.

4. Remove four screws that secure fan guard to radiator cradle; remove fan guard.

5. Remove two radiator cradle clamp screws, remove radiator cradle clamps, and brace radiator forward to gain access to fan.

6. Remove two power steering pump bracket to cylinder block screws, and position pump and bracket to one side. Do not disconnect hoses. Remove power steering pump belt.

7. Remove four cap screws that hold fan blade assembly to water pump and remove fan blade assembly (or hub-spacer and fan on non-air conditioned cars), pulley and generator drive belt.

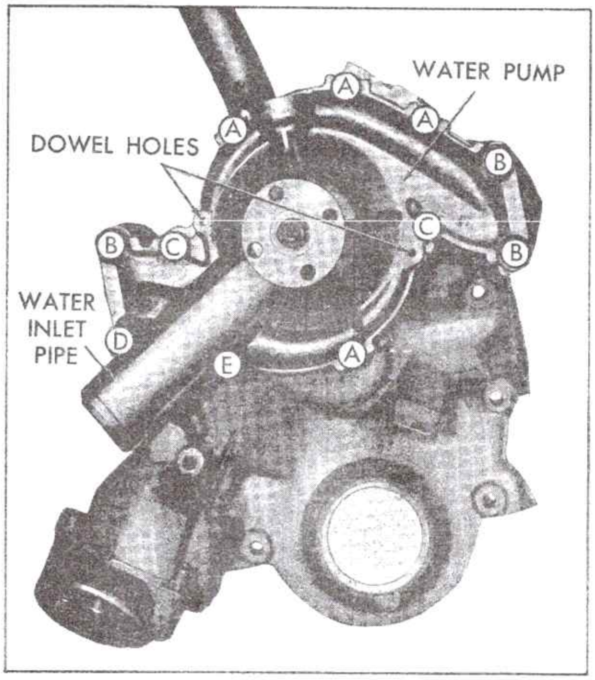
NOTE: Fan clutches used on air conditioned cars are always to be in an "in car position." When removed from car for any service procedure, support assembly to keep clutch disc in a vertical plane to prevent leaks of silicone fluid from clutch mechanism.

8. Remove generator to support bracket cap screw.

9. Release clamp and disconnect water inlet hose at water pump. Release clamp and disconnect upper radiator hose from thermostat housing.

10. On cars equipped with A.I.R. system, remove three cap screws that hold air pump front mounting bracket to engine front cover assembly. Loosen air pump belt adjusting bolt and air pump to air mounting bracket bolt to gain access behind air pump front mounting bracket.

11. Remove four cap screws that hold cylinder head water outlet pipe to cylinder heads and remove water outlet pipe. Discard flange surface gaskets and O-ring seal from neck of water outlet pipe.



Key	No.	Size	Torque
A	(4)	1/4 -20 x 1-1/4	5 Foot-Pounds
B	(3)	3/8 -16 x 3-4/8	20 Foot-Pounds
C	(2)	5/16-18 x 3-1/4	10 Foot-Pounds
D	(1)	3/8 -16 x 5	20 Foot-Pounds
E	(1)	1/4 -20 x 2-1/4	5 Foot-Pounds

Fig. 6-4 Water Pump Assy. Attaching Screws

12. Remove remaining nine cap screws that hold water pump to engine front cover and remove water pump.

b. Installation

1. Position new gasket on water pump locating dowels.

2. Position water pump on engine front cover, lining up dowel holes in pump with dowels on front cover, and install nine cap screws. See Fig. 6-4 for torque specifications on attaching screws.

3. Lubricate new water outlet pipe to water pump O-ring seal with silicone, and install new O-ring in pump body against shoulder in bore.

4. Brush gasket cement on water outlet pipe flange surfaces and place new flange gaskets on water outlet pipe.

5. Install neck of water outlet pipe in bore in pump body, position flange surfaces against cylinder heads, and secure with four attaching screws. Tighten screws to 20 foot-pounds.

6. On cars equipped with A.I.R. system, position air pump front mounting bracket on engine front cover assembly and secure with three cap screws. See Fig. 6-121 for torque specifications on attaching screws. Install air pump drive belt and perform adjustment as outlined in Note 6-138b, Steps 7 and 8.

7. Connect water inlet hose to water pump and secure with hose clamp. Connect radiator hose at thermostat housing and secure with hose clamp.

8. Install pulley, fan blade assembly, (or hub-spacer and fan on non-air conditioned cars) on water pump and secure with four attaching screws. Tighten screws to 18 foot-pounds.

9. Install generator drive belt and perform generator drive belt adjustment as described in Note 6-41 for all cars except 693. For 693 cars, see Note 6-49.

10. Install power steering pump belt and power steering pump and bracket on cylinder block, and secure with two attaching screws. Tighten screws to 23 foot-pounds.

11. On Air Conditioned cars, except 693, install compressor as described in Section 1, Note 31b. On Air Conditioned 693 cars, see Section 1, Note 91b.

12. Position radiator and install radiator cradle clamps. Secure clamps with attaching screws. Tighten screws to 10 foot-pounds.

13. Install fan guard and secure with four attaching screws. Tighten screws to 10 foot-pounds.

14. Refill radiator with coolant.

15. Reconnect negative battery cable.

16. Run engine and check for coolant leaks at all connections.

DIAGNOSIS CHART

CONDITION	CAUSE	REMEDY
Engine overheats.	Loss of coolant.	Determine reason for loss and correct as necessary.
	Loss of system pressure.	Check radiator cap, replace as necessary. Check hose connections and tighten as necessary.
	Belt tension too low.	Tighten belt to specification.
	Radiator fins obstructed.	Clean away bugs, leaves, etc.
	Thermostat defective.	Install new thermostat.
	Cooling system passages blocked by rust or scale.	Flush cooling system - add fresh coolant, inhibitor and sealer.
	Fan clutch not engaging properly (as in slow speed high engine temperature conditions).	Install new clutch assembly.
	Water pump inoperative.	Replace water pump.
	Spark timing incorrect.	Set timing to specification.

DIAGNOSIS CHART (Continued)

CONDITION	CAUSE	REMEDY
Engine fails to reach normal operating temperature.	Thermostat stuck open or of incorrect heat range.	Install new thermostat of correct type.
	Temperature sending unit defective (causing gage to indicate low engine temperature).	Replace sending unit.
	Temperature gage defective (not indicating true engine temperature).	Replace gage.
Loss of coolant.	Leaking radiator.	Repair radiator.
	Loose or damaged hoses or connections.	Reseat or replace hoses or clamps.
	Water pump seal leaking.	Replace water pump.
	Water pump gasket leaking.	Replace gasket.
	Cylinder head gasket leaking.	Replace gasket.
	Improper cylinder head screw torque.	Tighten screws to 60 foot-pounds.
	Cylinder block core plugs leaking.	Replace core plug.
	Cracked cylinder head or block or warped cylinder head or block gasket surface.	Resurface or replace.
	Radiator cap or sealing surface defective.	Repair or replace.
	Leaking heater core.	Repair or replace core.
	Leaking heater water control valve.	Replace valve.

TORQUE SPECIFICATIONS

Material Number	Application	Size	Torque
300M	Cylinder Head Screw	13/32-16	60 Ft. Lbs.
280M	Fan Blade Assembly Mounting Screw on Air Conditioned Cars	5/16-24	18 Ft. Lbs.
260M	Fan Blade Assembly Mounting Screw on Non-Air Conditioned Cars	5/16-24	18 Ft. Lbs.
280M	Fan Blade to Clutch Mounting Screw Air Conditioned Cars . .	5/16-24	20 Ft. Lbs.
1010	Heater Hose Clamp	10-24	13 In. Lbs.
280M	Thermostat Housing Screw	5/16-18	10 Ft. Lbs.
260M	*Water Pump to Cylinder Block Screw	3/8-16	20 Ft. Lbs.
260M	*Water Pump to Cylinder Block	5/16-18	10 Ft. Lbs.
260M	*Water Pump to Front Cover Screw	1/4-20	5 Ft. Lbs.
260M	Water Outlet Pipe to Cylinder Head Screw	3/8-16	20 Ft. Lbs.
	*Refer to Fig. 6-3 for proper screw location.		

NOTE: Refer to back of manual, Page 16-1, for nut and bolt markings and Steel Classifications.

SPECIFICATIONS

Belts	Type	Tension		Width	Length	
		New	Used		Except 693	693 Only
Power Steering Pump (Non-Air Conditioned Cars)	38° Wedge	100 Lbs.	55-70 Lbs.	.380"	49.94"	51.64"
Power Steering Pump (Air Conditioned Cars)	38° Wedge	100 Lbs.	55-70 Lbs.	.380"	50.24"	51.64"
Generator	38° Wedge	100 Lbs.	55-70 Lbs.	.470"	38.08"	48.55"
Air Conditioner Compressor	38° Wedge	100 Lbs.	55-70 Lbs.	.470"	56.00"	55.32"
A.I.R. System Air Pump	38° Wedge	100 Lbs.	55-70 Lbs.	.470"	43.20"	35.31"

Fan
- Drive Ratio . . . . 1.1 to 1
- Number of Blades Air Conditioned Cars 6
- Non-Air Conditioned Cars 7

Hoses
- Type . . . . Reinforced Molded
- Thermostat Housing to Radiator Inlet (Top) . . . . Diameter Inside 1.50"
- Radiator to Water Pump Inlet (Bottom) . . . . Diameter Inside 1.75"

Thermostat
- Starts to Open Air Conditioned Cars . . . . 177°F. to 182°F.
- Non-Air Conditioned Cars . . . . 192°F. to 197°F.
- Fully Open (Approximately .452") Air Conditioned Cars . . . . 202°F.
- Non-Air Conditioned Cars . . . . 217°F.

NOTE: For Cooling System Capacities, see Section 0.

GENERAL DESCRIPTION

Battery

The familiar 12-volt negative-ground type electrical system is used on all 1967 Cadillac vehicles. A 12-volt secondary solid top battery, Fig. 6-5, is mounted in a tray on the right side of the radiator cradle assembly. The retainer grooves, Fig. 6-5 and Fig. 6-6, in the front and rear bottom sides of the battery secure the battery to the tray and hold-down retainer. Internal structure of the battery consists of 6 cells and 78 plates. This battery has a capacity of 73 ampere hours.

The lead acid battery is a source of electrical energy that operates or assists in supplying current to the electrical accessories. Active materials within the battery react chemically to produce a flow of direct current whenever a current-consuming device is connected to the battery terminal posts. A battery does not store electricity but creates electrical energy by chemical action.

Starter

The starter motor is mounted on the right rear side of the engine. The starter motor has four pole shoes and a two series field. The drive end housing is extended to enclose the entire shift lever mechanism. An overrunning clutch drive is used to engage the cranking motor pinion with the transmission flywheel.

When the control switch is closed, the solenoid is energized, shifting the cranking motor pinion into mesh with the flywheel. The main contacts of the solenoid are then closed so that battery current is delivered to the starter motor.

Distributor

The distributor is mounted on the top left front side of the engine front cover. It is fully automatic in operation, and driven by an alloy iron drive gear that meshes with a gear that is integral with the camshaft. The distributor cam rotates in a clockwise direction when viewed from above. The firing order is 1-8-7-2-6-5-4-3.

The distributor houses the contact points that make and break the circuit, and also directs high voltage current in proper sequence to the spark plugs. The distributor contact point set is replaced as a complete assembly. The breaker lever spring tension and point alignment on the replacement set are factory adjusted, leaving only the dwell angle to be adjusted after installation.

The large molded distributor rotor, located above the breaker plate assembly serves as a cover for the centrifugal advance mechanism, and distributes high voltage current to fire the spark plugs.

A new method for operating the vacuum advance has been developed for use on all 693

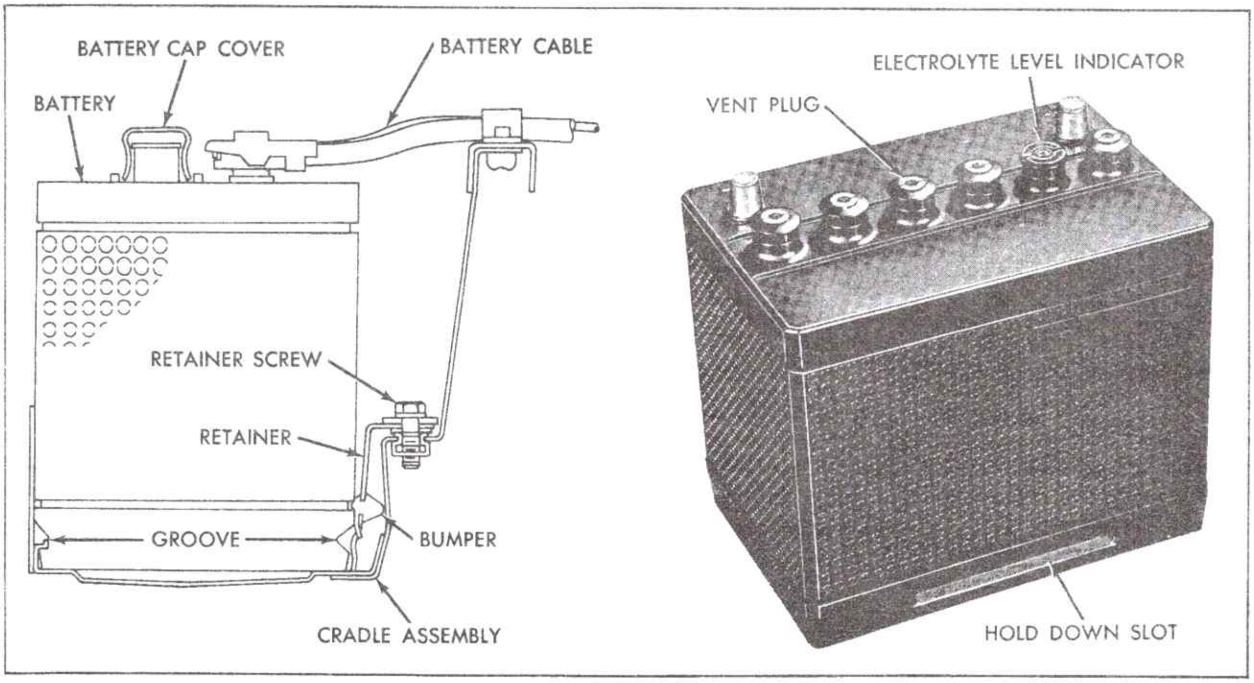


Fig. 6-5 Battery (Battery Retainer Except 693)

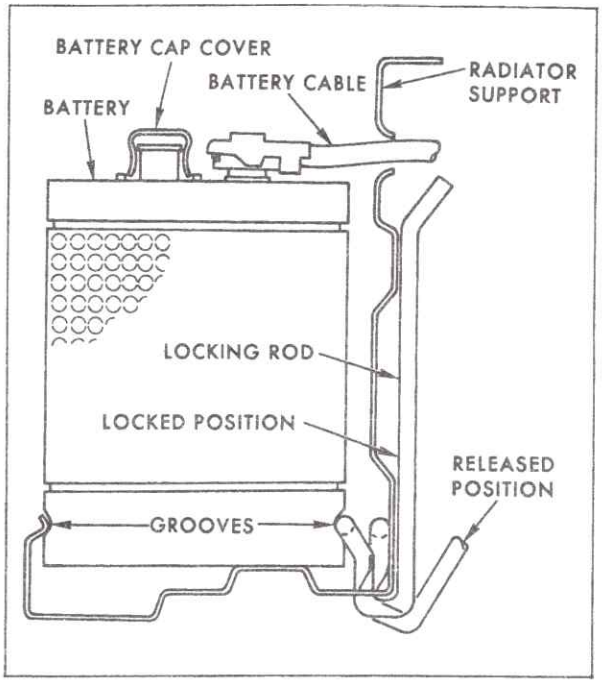


Fig. 6-6 Battery Retainer (693)

and 697 series cars when equipped with air conditioning. A thermostatically controlled vacuum distribution switch is mounted in the upper section of the left hand radiator tank.

When the coolant temperature is below 230°F, carburetor vacuum is supplied to the vacuum advance mechanism through the thermo switch. Once the coolant temperature rises above 230°F, the switch closes the carburetor supply port and opens the manifold supply port.

This sytem is designed primarily to provide more precise spark control during prolonged idling periods or in unusually warm weather. Under these conditions some spark advance is desirable, and since air flow through the carburetor venturies is nominal, and carburetor vacuum is low, stronger manifold vacuum must be used to operate the vacuum advance unit to achieve the objective.

During normal operation, carburetor vacuum operates the vacuum advance unit because it more closely follows actual engine requirements.

The distributor is permanently lubricated and requires no periodic oiling. However, when the rotor is removed, the centrifugal advance mechanism should be inspected for lubricant. If necessary, a small amount of cam and bearing lubricant should be applied to the advance weights.

Timing marks, numerals 0, 5, and 10, are located on the left side of the engine front cover, directly below the distributor cap. The pistons in number one and six cylinders are at top dead center when the 0 mark is in line with scribe line on the harmonic balancer. The 5 mark and the 10 mark indicate the number of crankshaft degrees the spark plug will fire ahead of the top dead center position of the piston.

Type 44 spark plugs are installed as original equipment on all 1967 Cadillac engines. A ribbed insulator is used to reduce the possibility of voltage breakdown. To eliminate the need for separate radio suppressors on the spark plugs, resistance core spark plug cables are used for suppression.

The oil-impregnated ignition coil is mounted on top of the intake manifold in front of the carburetor. The interrupted low tension voltage from the battery produces a high voltage in the secondary circuit of the coil. A resistance type wire is connected from the ignition switch to the ignition coil in the primary circuit. This resistor reduces the voltage at the coil from 12 volts down to a range of 8-1/2 to 10-1/2 volts under normal operating conditions. To insure adequate ignition voltage during the engine cranking period, the resistor wire is shunted by a feed from the starter solenoid, and full battery voltage is supplied to the ignition coil during this period.

Generator (All Except Commercial Chassis Option)

The generator is mounted on the right front side of the engine. A 42 ampere generator is used on all non-Air Conditioned cars, except the Fleetwood Seventy-Five sedan and limousine, and the Commercial Chassis. A 55 ampere generator is used on the Fleetwood Seventy-Five sedan and limousine, commercial chassis and all other cars equipped with Air Conditioning and seat warmers.

The generator consists primarily of a drive end frame, a slip ring end frame, a stator assembly and a rotor assembly. The rotor assembly is supported in the drive end frame by a ball bearing and in the slip ring end frame by a roller bearing.

The stator assembly, mounted between the two end frames, consists of loops of wire wound into the slots of the laminated stator frame. The rotor assembly contains a field coil wound on an iron spool. The coil and spool are mounted between two iron segments with interlacing poles. These parts are held together by a press fit on the shaft. Two slip rings, upon which the brushes ride, are mounted on the rotor shaft. The brushes carry current through the slip rings to the field coil.

Six electronic check valves called diodes are located in the end frame assembly nearest the slip rings. Three of these diodes are negative and are mounted directly to the end frame. Three positive diodes are mounted into a strip called a "heat

sink", which is insulated from the end frame. The six diodes change the alternating current voltages developed in the stator windings to direct current voltage at the "BAT", or output, terminal of the generator.

Regulator

(All Except Commercial Chassis with Optional Generator)

The voltage regulator assembly is mounted on the right fender dustshield in a waterproof case.

A double contact voltage regulator and a field relay are the principal parts of this assembly. The voltage regulator unit limits the voltage output. The field relay unit connects the generator field winding and regulator winding to the battery.

The regulator internal circuits are shown on the wiring diagram, Fig. 6-7. When the ignition switch is in the "ON" position, the tell-tale generator lamp glows to indicate that the generator is not charging. Current then flows from the positive battery terminal, through the battery terminal on the switch, through the indicator lamp and resistance wire (which are in parallel), and on to the regulator No. 4 terminal.

Within the regulator unit, current flows through the lower set of voltage regulator contacts to the "F" terminal. Current then flows through the generator field winding to ground. Enough current is thus supplied to the field winding to insure that the stator winding voltage is built up when the engine starts.

As the generator begins to operate, voltage from the "R" or relay terminal of the generator flows to the regulator No. 2 terminal, causing the field relay contacts to close. This connects the regulator No. 4 terminal directly to the battery through the field relay contacts, which applies system voltage to the regulator side of the tell-tale indicator lamp. With equal system voltage on the battery side of the indicator lamp, there is no current flow and the indicator lamp will go out. Generator field current then flows from the generator output terminal to the regulator No. 3 terminal and through the field relay contacts and the voltage regulator lower contacts to the field winding.

As the generator rpm increases, the voltage at the "BAT" or output terminal also increases. This impresses a higher voltage through the field relay contacts and across the voltage regulator shunt winding. The magnetism developed in the winding causes the lower, or series, contacts of the voltage regulator to separate. The field current then flows to ground through a resistor that reduces field current.

This reduced field current causes the generator voltage output to decrease, thereby decreasing the

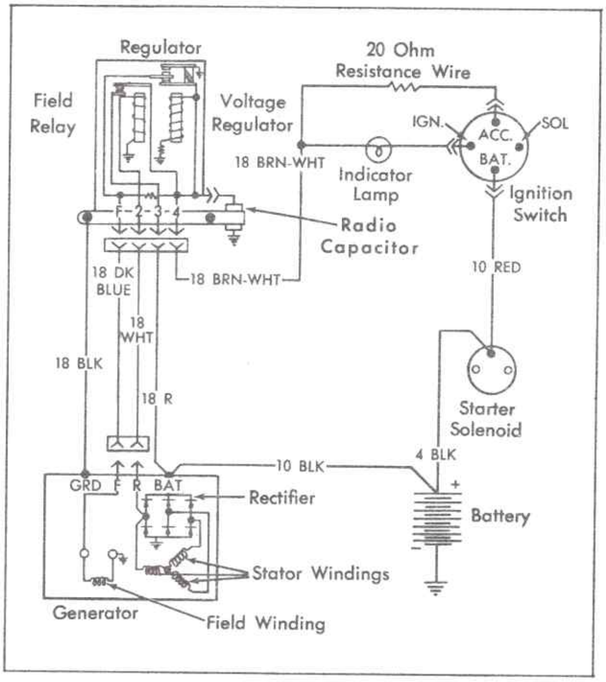


Fig. 6-7 Basic Charging Circuit

magnetic pull of the voltage regulator shunt winding. A spring overcomes the weakened magnetism and closes the contacts. This cycle repeats itself many times per second to limit the generator voltage to the pre-set value.

As the generator speed increases even further, the resistor connected across the contacts is not large enough to maintain voltage control of the contacts. However, when the voltage increases slightly above the setting, this causes the upper or "shorting" contacts to close. When this happens, the generator field winding is shorted so that no current passes through the winding.

With no current in the field winding, the generator voltage output decreases sharply. This reduces the magnetism in the shunt winding and allows the upper contact points to open. With these points open, field current again flows through the resistor and the field winding. As the voltage increases, the contacts again close. This cycle repeats many times per second to limit the generator voltage to the pre-set value at high generator speeds.

The voltage regulator unit operates to limit the value of the generator voltage throughout the entire generator speed range, protecting all electrical units and accessories from too high a voltage, which could damage them. The self-limiting current output feature of the generator eliminates the need for a current regulator.

Generator (Optional On Commercial Chassis Only)

The optional generator for the commercial

chassis is mounted on the right front side of the engine by a special bracket. This special 130 ampere generator is available as an option only on these models.

The generator consists primarily of a drive end frame, a slip ring end frame, a stator assembly and a rotor assembly. The rotor assembly is supported at each end frame by a ball bearing.

The rotor is mounted on ball bearings, and each bearing has a grease reservoir that eliminates the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coils which are wound on the rotor.

The stator windings are assembled on the inside of a liminated core that forms the generator frame. Six rectifier diodes are mounted in the slip ring end frame and are connected to the stator windings.

This generator also features three A.C. terminals in addition to the "BAT" terminal. On this generator, a transformer may be connected to the A.C. terminals to step up the A.C. voltage. The high A.C. voltage, usually 110-120 volts, may be used directly to power A.C. accessories, or it may be rectified to provide 110-120 volts D.C.

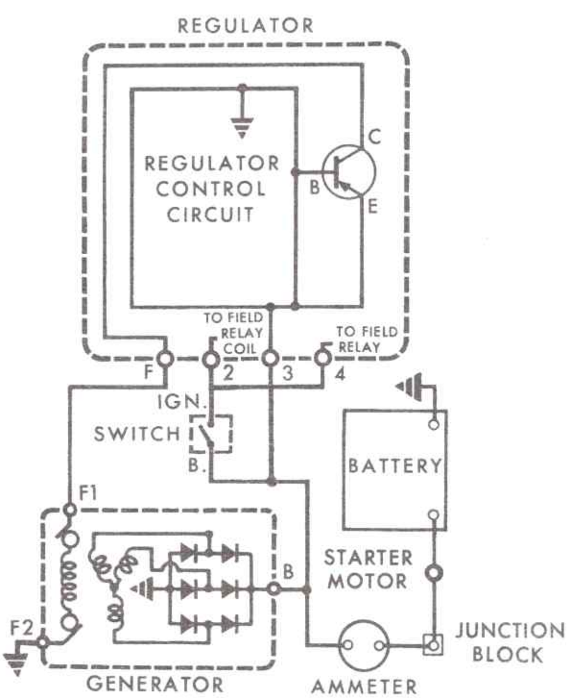


Fig. 6-8 Generator Regulator Circuit

Regulator (Commercial Chassis with Optional Generator Only)

The transistor regulator illustrated in Fig. 6-48, limits the voltage developed by the generator, by regulating the amount of field current.

This regulator is used with an ammeter, as shown in schematic diagram Fig. 6-49. The generator field current through the regulator is supplied to the regulator from the battery through the ignition switch. Field current is provided in this manner for initial generator voltage build-up.

The transistor is an electrical device made of semi-conductor materials which is used as a switch to control the generator field current. Fig. 6-8 is a simplified diagram of the generator and regulator circuit. A brief description of the operation follows:

When the ignition switch is closed, battery voltage supplies current through the emitter (E) and collector (C) of the transistor to the field coil of the generator. This emitter-collector circuit is complete since the transistor is turned "ON" by a higher voltage on the emitter than on the base (B), which permits emitter-base current to flow. The flow of current to the field circuit of the generator provides the magnetic field for the generator. When the engine is started, the generator builds up voltage. This causes current to flow to charge the battery and power the electrical devices.

As generator speed increases or the load decreases, generator voltage builds up to the regulator setting. The electrical control portion of the regulator then places a higher voltage on the base of the transistor than is impressed upon the emitter, and the transistor is turned "off." With no current flow in the emitter-collector circuit, there is no current flow in the field coil of the generator, and generator voltage drops below the setting.

The electrical control portion of the regulator then provides a lower voltage on the base of the transistor than that on the emitter, and the transistor is again turned "on". With current flow again in the emitter-collector and field coil circuit, the magnetic field is reestablished in the generator, and generator voltage again builds up to the setting of the regulator.

This switching "on" and "off" of the transistor regulates the amount of field current supplied to

the generator. The frequency of this switching depends primarily upon the electrical load and generator speed. Under certain conditions the "on" and "off" cycle is repeated as much as 7,000 times per second.

This voltage regulator has no moving mechanical parts. It is sealed to make it highly water resistant. An external adjustment is provided. Adjustment can be made without removing the regulator cover, and without the warm-up periods necessary on many regulators.

SERVICE INFORMATION

BATTERY

The following battery service information applies to all 1967 Cadillac vehicles.

8. Battery Filling Instructions

The battery electrolyte level should be checked at every engine oil change. In warm weather, a check should be made at two-week intervals. An electrolyte level indicator vent cap is located in the second cell cap from the positive battery post. With the use of this vent cap, it is not necessary to remove cell vent caps when checking fluid level. A dark (black) spot in the center of this vent cap is visible when electrolyte is at the normal level. If at any time the electrolyte level drops below normal, the spot changes from black to an off-white color. When an off-white condition is encountered, all cell fluids must be adjusted to their correct level. This is accomplished by raising the fluid level to the bottom of the slot in each cell with colorless, odorless drinking water.

CAUTION: Do not overfill battery or add any substance to fluid except colorless, odorless drinking water.

9. Testing Battery Condition

A new battery testing instrument, designated a "421 Tester", is now available to test the solid top batteries of all 1967 Cadillac cars. These "421" testers, manufactured by several test equipment companies, will quickly determine the condition of the battery relative to state of charge. The "421" test, the specific gravity cell comparison test, and the full charge hydrometer test may be used on solid top batteries as discussed in the following notes.

10. 421 Test

The "421 Test" is a specific, programmed test procedure consisting of a series of timed discharge and charge cycles that will determine the condition of the battery with a high degree of accuracy in a very short period of time. "421" Testers are manufactured by a number of different suppliers, and these testers automatically subject the battery to the programmed "421 Test."

When using one of these testers, the procedure recommended by the tester manufacturer should be followed. If a tester is not available to perform the "421 Test", the "Specific Gravity Cell Comparison Test" or a probe type tester may be used.

11. Use of Hydrometer

The hydrometer measures the percentage of sulphuric acid in the battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, the acid leaves the solution and enters the plates, causing a decrease in specific gravity of electrolyte. An indication of the concentration of the electrolyte is obtained with a hydrometer.

The specific gravity of the electrolyte varies not only with the percentage of acid in the liquid but also with temperature. As temperature increases, the electrolyte expands so that the specific gravity is reduced. As temperature drops, the electrolyte contracts so that the specific gravity increases. Unless these variations in specific gravity are taken into account, the specific gravity obtained by the hydrometer may not give a true indication of the concentration of acid in the electrolyte.

Correction can be made for temperature by adding .004, usually referred to as four "points of gravity", to the hydrometer reading for every 10° F. that the electrolyte is above 80°F. or subtracting .004 for every 10°F. that electrolyte is below 80°F. Fig. 6-9 shows the exact correction figure to use for any temperature above or below 80°F., the three steps used in obtaining the corrected or true specific gravity, and two examples showing how it is determined.

If the electrolyte temperature is not too far from the 80°F. standard, or if only an approximate idea of specific gravity reading is required, it will not be necessary to make the temperature correction. Hydrometers are available which have a built-in thermometer and temperature correction scale similar to Fig. 6-9. This type of hydrometer simplifies obtaining a true specific gravity reading.

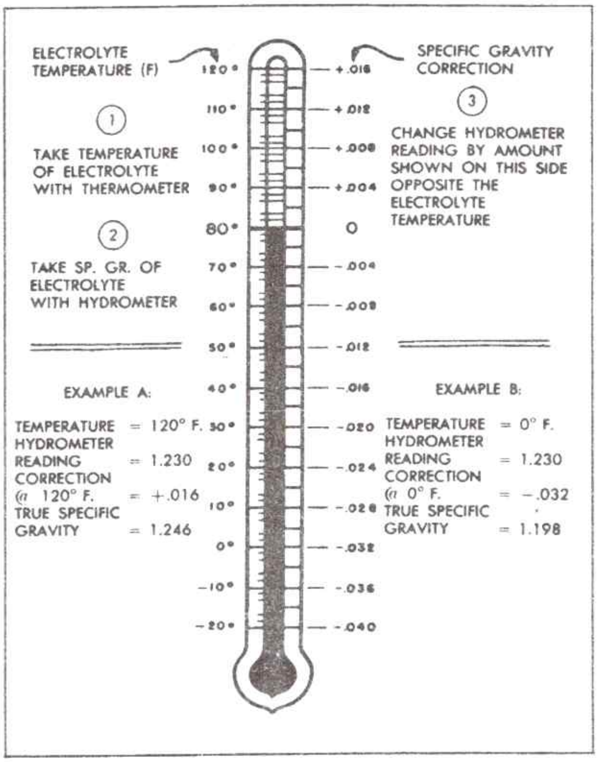


Fig. 6-9 Specific Gravity Temp. Correction Scale

When using a hydrometer, observe the following points:

1. Hydrometer must be clean, inside and out, to insure an accurate reading.

2. Hydrometer readings must never be taken immediately after water has been added. The water must be thoroughly mixed with the electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.

3. If hydrometer has builtin thermometer, draw liquid into it several times to insure correct temperature before taking reading.

4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard the curvature where the liquid rises against float stem due to surface tension.

5. Avoid dropping battery fluid on car or clothing as it is extremely corrosive. Any fluid that drops should be washed off immediately with baking soda solution.

12. Specific Gravity Cell Comparison Test

1. Visually inspect the battery for a broken or cracked case, broken or cracked cover, odors, or leaks around damaged terminal posts. If severe damage is found, replace the battery.

2. Measure the specific gravity of each cell in the battery and the temperature of one of the center cells. Interpret readings as shown below.

NOTE: If the electrolyte level is too low to be checked by a hydrometer, adjust electrolyte to the proper level by adding colorless, odorless drinking water. After water addition, the specific gravity check cannot be made until the battery is charged at a rate high enough to cause vigorous gassing for a period of 15 minutes or more. This insures that added water is mixed with the electrolyte before a specific gravity reading is taken.

13. Full Charge Hydrometer Test

NOTE: The full charge hydrometer test should not be used unless the battery has been tested and found good by the battery test as described in Note 12.

1. Be certain that the battery is fully charged.

2. Measure the specific gravity of the electrolyte in each cell and compare the readings with the following:

Specific Gravity Difference Between Highest and Lowest Cells	Specific Gravity of Lowest Cell (Temp. Corrected)	Interpretation
Less than 50 points	More than 1.200	Good battery (1) - Satisfactorily charged
Less than 50 points	Less than 1.200	Good battery (1) - Requires charging
More than 50 points	—	Defective battery - Replace

(1) Fully charge and re-test those batteries that pass the specific gravity test but fail to perform satisfactorily. Any cell indicating a specific gravity reading (corrected for temperature) of less than 1.230 means that the battery is defective and should be replaced.

a. When the specific gravity of the electrolyte falls within the 50 point variation between cells and the 1.230 to 1.310 specific gravity range, the battery is ready for use.

b. If any cell reads less than 1.230 and battery has been in service three months or less, battery is good, but it has been improperly filled with electrolyte or water and will give poor performance. To correct this condition, empty the electrolyte from the cell reading less than 1.230 and refill with electrolyte having a specific gravity of 1.265.

c. If any cell reads less than 1.230 and the battery has been in service three months or more, it should be replaced.

d. If any cell reads above 1.310, the battery may be returned to service. However, specific gravities above 1.310 are harmful to the battery and will cause an early failure. Such high readings are caused by the improper addition of electrolyte. Adjusting the specific gravity by pouring out the old solution and replacing it with electrolyte of the correct specific gravity will not correct the damage that has been done.

14. Causes of Low Battery Conditions

Common causes of low battery conditions other than those due to a defective battery are listed below, and should be investigated when there are indications that the car has a consistently low battery.

1. Excessive use of accessories with the engine not running.

2. Leaving lights on or doors open.

3. Improper installation of accessories.

4. Generator belt loose.

5. Incorrect regulator settings. These can be corrected and set, preferably toward high limit, as explained in Notes 52 or 59.

6. Oxidized regulator contact points.

7. Self-discharge resulting from a dirty battery case.

8. Loose battery cables.

9. Low generator output, which may be checked and corrected as explained in Notes 45 or 57.

10. A partial ground in positive side of battery circuit. With clock disconnected and all switches in "Off" position, a milliameter or voltmeter connected in series between battery positive post and battery cable should indicate zero.

11. High resistance in charging circuits.

15. Battery Visual Inspection

1. Inspect positive battery cable and negative ground cable for corrosion or damage.

2. Inspect metal carrier for corrosion. If corrosion exists, it will be necessary to remove retainer and battery from car and pour warm soda or ammonia water over corroded areas to loosen the corrosion so that it can be brushed off and flushed away.

3. The hold-down retainer should be kept tight enough to prevent the battery from shaking in its holder and to prevent damage to the battery case.

4. The battery posts and terminals should be inspected for corrosion. If corroded, wipe off the posts and terminals with a cloth dampened with household ammonia, or with a solution of water and baking soda. These alkaline solutions will neutralize any acid on parts being cleaned.

CAUTION: Care should be taken to keep cleaning solution out of battery cells; otherwise, the electrolyte will become permanently weakened.

5. Examine battery for cracks in case and excessive looseness in battery tray.

16. Battery Removal and Installation (All Except 693)

a. Removal (Fig. 6-5)

1. Disconnect negative and positive battery cables at battery by spreading spring type clamps with pliers, and lift clamps off posts.

CAUTION: Do not spread cable clamps any more than necessary. Do not pry clamps off battery posts.

2. Remove screw and washer from hold down retainer at rear of battery. Remove hold down retainer and remove battery from vehicle, being careful not to damage posts.

b. Installation (Fig. 6-5)

1. Clean all corrosion from battery posts and cable clamp terminals.

2. Install battery on battery tray. Slide battery all the way forward so that retainer tabs on tray are positioned in groove in front bottom of battery.

3. Install battery hold-down retainer on radiator cradle assembly so that retaining tabs on

retainer are positioned in groove in rear bottom of battery, Fig. 6-5.

4. Secure battery hold-down retainer with attaching screw and washer. Torque retainer screw to 6 foot-pounds.

5. Connect positive battery cable first then negative cable. Spread clamps with pliers and push them onto the battery posts as far as possible. When installed, the clamps should be from flush with the top of the posts to approximately 1/8 inch below the top.

CAUTION: Do not drive clamps onto battery posts with hammer or other tool. The spring ring inside the clamp should never be reamed or cut as this will damage it.

6. Apply a light coat of oil or grease to the clamp terminals.

17. Battery Removal and Installation (693 Only)

a. Removal (Fig. 6-6)

1. Disconnect negative and positive battery cables at battery by spreading spring clamp with pliers, and lift clamps off post.

CAUTION: Do not spread cable clamps any more than necessary and do not pry clamps off battery post.

2. Push locking rod, at rear of radiator support, toward engine (approximately four inches) and remove battery, being careful not to damage posts.

b. Installation (Fig. 6-6)

1. Clean all corrosion from battery posts and cable clamp terminals.

2. Position battery on battery tray. Slide battery all the way forward so that retainer tabs are positioned in grooves near bottom of battery.

3. Move locking rod, at rear of radiator support to vertical position next to support, Fig. 6-6.

4. Connect positive battery cable first, then negative cable. Spread clamps with pliers and push them onto battery posts as far as possible. When installed the clamps should be from flush to 1/8 inch below top of post.

CAUTION: Do not drive clamps onto battery posts with hammer or other tool. The spring ring inside the clamp should never be reamed or cut as this will damage it.

5. Apply a light coat of oil or grease to the clamp terminals.

18. Care of Batteries Not in Use

Batteries in cars that are being stored require special care to prevent plate sulphation or other deterioration due to chemical action.

Before a wet charged battery is stored, an inspection should be made to see that it is filled to the proper level and that it is fully charged (1.250-1.280).

Wet batteries in storage should be checked every 30 days and given a boost charge of 25 per cent of the ampere - hour capacity of the battery at a rate of 5 amperes.

STARTING SYSTEM

19. Starter Motor Circuit

The starter motor is engaged when the ignition key is turned to the extreme right position. Engagement is obtained by means of a solenoid, Fig. 6-10, attached to the starter housing. The solenoid first engages the starter pinion with the flywheel gear and then closes the main switch so that the battery current is delivered to the starter motor.

When the ignition key is held in the extreme right position, the starter solenoid is drawn into the engaged position by both the pull-in coil and the hold-in coil, and held in position by the hold-in coil only, Fig. 6-10. The contact bar at the end of the solenoid completes a direct circuit between the battery and the starter motor, energizing the starter motor and shorting out the pull-in coil.

The current consumption of the solenoid switch should be 41-47 amperes at 10 volts for both windings, and 14.5 - 16.5 amperes at 10 volts for the hold-in winding alone.

20. Starter Motor Maintenance

Lubrication—When the starter motor is disassembled for service, apply a light coating of lubricant (available from your parts warehouse) on the bushings in the end bearings. Avoid excessive lubrication, as this might force lubricant

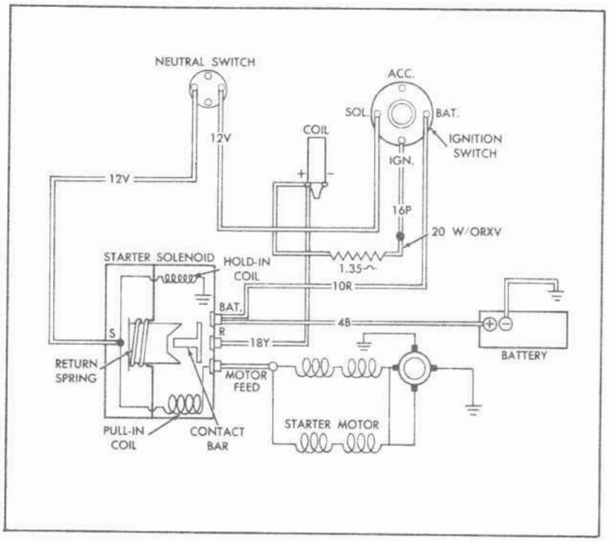


Fig. 6-10 Starting System Circuit

out onto the commutator where it would gum and cause high resistance, resulting in poor starter motor performance. Never lubricate the commutator.

21. Starter Motor Circuit Resistance Test

a. Battery Cable and Starter Switch Test—Insulated Circuit Test

This test measures the resistance of the cables and switches that feed the starter motor. The heavy current used by the starter motor will produce a voltage drop in the wiring which can be measured as an indication of this resistance. The battery should be fully charged.

1. Disconnect primary lead of distributor from coil so engine will not start.

CAUTION: Do not remove high tension lead from coil center for this purpose, as this may damage the coil due to internal arcing.

2. Using Battery Starter Tester, turn voltmeter selector switch to 16 volt scale.

3. Connect starter solenoid remote switch and test leads as shown in Fig. 6-11.

4. Connect positive voltmeter lead to center of positive battery post, on which insulated battery cable is connected. Connect negative voltmeter lead to starting motor terminal, Fig. 6-11.

5. Close starter solenoid remote switch, and turn voltmeter to 4 volt scale while cranking. Observe reading, and immediately turn meter back to 16 volt scale.

6. Voltmeter should show .6 of a volt or less

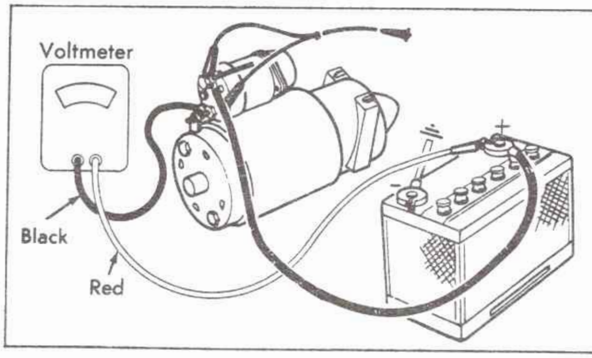


Fig. 6-11 Battery Cable to Starter Test

while engine is being cranked. If voltage drop is more than .6 of a volt, it is an indication that the cables or connections are dirty or corroded, the solenoid switch is defective, the battery is in a low state of charge, the starter motor is drawing too much current, or that the engine is too tight.

7. If voltage drop across the entire insulated side of the battery starter circuit exceeds the specified .6 volt, test the individual parts of the insulated circuit for excessive resistance. Maximum voltage drop for each should not exceed the following specifications:

a. Battery to Solenoid Switch	.4 volt
b. Across Solenoid Battery Terminal	.2 volt
c. Solenoid switch to Starter Terminal	Zero

b. Ground Circuit Test

1. Turn voltmeter selector switch of Battery Starter Tester to 4 volt position.

2. Connect test leads as shown in Fig. 6-12.

3. Connect starter solenoid remote switch as shown in Fig. 6-12.

4. Connect negative voltmeter lead to a clean spot at center of negative battery post, not to the cable clamp.

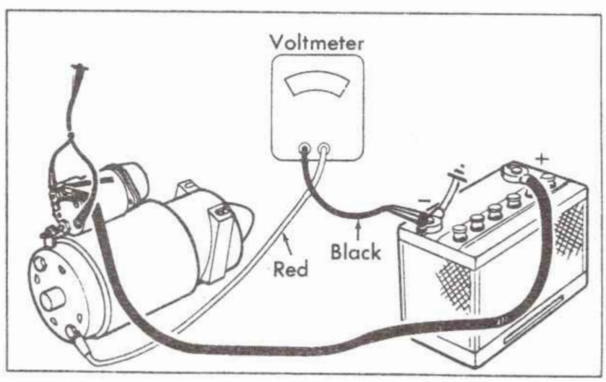


Fig. 6-12 Ground Circuit Test

5. Connect positive voltmeter lead to the starting motor through bolt.

6. With starter motor cranking engine, voltage drop should not exceed .3 volt. A reading of more than .3 volt is usually an indication of resistance due to loose, dirty, or corroded connections.

7. Connect primary lead of distributor to coil.

22. Checking Starter Motor Pinion Clearance

a. Preferred Method (Fig. 6-13)

1. Remove starter motor from car as described in Note 26 or 27.

2. Energize solenoid by applying 6 volts between solenoid "S" terminal and ground.

CAUTION: Do not use more than 6 volts or motor will operate. As a further precaution, connect a heavy jumper wire from the solenoid motor terminal to ground.

3. After energizing solenoid, press on clutch, Fig. 6-13, to take up movement.

4. Push pinion away from stop retainer as far as possible and use feeler gage to check clearance between starter motor pinion and pinion stop retainer, Fig. 6-13. Clearance should be .010 inch to .140 inch when pinion is in cranking position.

b. Alternate Method (Fig. 6-13)

If a six volt battery is not available, pinion clearance may be checked with a 12 volt battery in the following manner:

1. Remove starter motor from car as described in Note 26 or 27.

2. Disconnect the motor field coil connector from the solenoid motor terminal and insulate it carefully.

3. Connect a 12 volt battery from the solenoid switch terminal to the solenoid frame.

4. Momentarily connect a jumper lead from the solenoid motor terminal to the solenoid frame. This will shift the pinion into cranking position and hold it there until the battery is disconnected.

5. After energizing solenoid, press on clutch, Fig. 6-13, to take up movement.

6. Push pinion away from stop retainer as far as possible and use feeler gage to check clearance between starter motor pinion and pinion stop retainer, Fig. 6-13. Clearance should be .010 inch to .140 inch when pinion is in cranking position.

NOTE: Pinion clearance cannot be adjusted. If clearance is incorrect, disassemble starter motor and check for excessive wear of solenoid linkage, shift lever mechanism or improper assembly of these parts. All worn parts must be replaced.

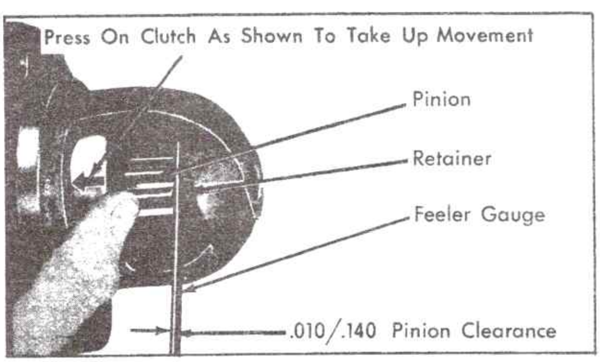


Fig. 6-13 Checking Pinion Clearance

23. Checking Inoperative Starter Motor

If starter motor cranks engine slowly or not at all, check battery, battery terminals and connections, ground cable, and battery-to-starting motor cable. Corroded, frayed, or broken cables should be replaced, and loose or dirty connections corrected.

The overrunning clutch should withstand 80 to 85 foot-pounds torque without slipping. The pinion should turn freely and smoothly in the overrunning direction. The solenoid switch contacts should be checked for a burned condition, and the contact disc and terminal studs should be replaced if necessary.

Inspect brushes and commutator. Brushes should form a good contact with commutator and have the correct spring tension. If there are burned bars in the commutator, it may indicate open circuited armature coils that may prevent proper cranking. Inspect soldered connections at commutator rise bars, and resolder these connections and turn down the commutator as necessary.

Tight or dirty bearings will reduce armature speed or prevent the armature from turning. A worn bearing, bent shaft, or loose pole shoe will allow armature to drag, causing slow speed or failure of the armature to rotate. Check for these conditions. If brushes, bearings, commutator, and external circuit are all right, and starter motor still does not operate correctly, remove starter motor for Bnech Check as to NO-LOAD and RESISTANCE tests.

24. Starter Motor Bench Tests

a. No Load Test

1. Connect starter motor and solenoid in series with the battery through ammeter leads of Battery Tester, or suitable ammeter capable of indicating 400 amperes. Connect positive voltmeter lead of tester to battery terminal of solenoid and connect negative lead to starter motor housing.

2. Connect jumper wire from battery terminal of solenoid to solenoid winding terminal, thus energizing starter motor.

3. Vary carbon pile resistance until voltage across motor and solenoid is 10.6 volts. Current draw of motor and solenoid should be 70-99 amperes.

b. Resistance Test

Check capacity of motor by using a 600 ampere meter and a carbon pile rheostat to control voltage. Apply 3.0 volts across motor with armature locked. Current should be 410-480 amperes.

25. Interpretation of No-Load and Resistance Tests

1. Low free speed and high current draw with low torque:

a. Tight, dirty or worn bearings, bent shaft or loose pole shoes.

b. Grounded armature or field. Check further by isolating various parts of motor and checking with a test lamp to determine location of ground.

NOTE: End of shunt field coil must be disconnected from ground before checking for grounded armature or field.

c. Shorted armature. Check on growler.

2. Failure to operate with high current draw:

a. Direct ground in switch, terminal or fields.

b. Frozen shaft bearings.

3. Failure to operate with no current draw:

a. Open field cirucit. Inspect internal connections and trace circuit with a test lamp. (See note concerning shunt field in step 1b.)

b. Open armature coils. Inspect commutator for badly burned bars.

c. Broken or weak brush springs, worn brushes, high mica on commutator, or other causes which prevent contact between brushes and commutator.

4. Low no-load speed with low torque and low current draw:

a. An open field winding. Check with a test lamp to determine "open" location. (See note concerning shunt field in step 1b.)

b. High internal resistance due to poor connections, defective leads, dirty commutator, and causes listed under step 3c.

5. High free speed with low developed torque and high current draw indicates shorted fields.

26. Starter Motor—Removal and Installation (All Except 693)

a. Removal

1. Disconnect negative battery cable at battery.

2. Raise front end of car and place on jack stands.

3. Disconnect battery lead at starter solenoid terminal.

4. Disconnect neutral safety switch wire and coil feed wire at starter solenoid terminals.

5. Remove spring clip securing wires to solenoid housing.

6. Remove two screws and washers that hold starter motor lower brace between starter housing and transmission lower cover, and remove brace.

7. Remove screw, flatwasher, and lockwasher that hold starter motor upper mounting bracket to engine block.

8. Remove two special screws that hold starter motor to engine block.

9. Remove starter by pulling it forward and over transmission cooler pipes, then lower starter between idler arm and frame.

NOTE: It may be necessary to turn front wheels several times to allow starter to be lowered between idler arm and frame.

b. Installation

1. Position starter motor between idler arm and frame.

2. Push starter motor up and over transmission cooler pipes until gear end of starter motor is toward transmission.

3. Install starter motor on engine block and install two special screws that hold starter to engine block. Tighten screws to 23 foot-pounds.

4. Install screw, flatwasher, and lockwasher that hold starter motor upper mounting bracket to engine block. Tighten screw to 10 foot-pounds.

5. Install starter motor lower brace on starter motor and transmission lower cover, and secure with two screws and flatwashers. Tighten screws to 10 foot-pounds.

6. Connect battery lead, coil feed wire, and neutral safety switch wire to starter solenoid terminals.

7. Install spring clip securing solenoid wires to solenoid housing.

8. Connect negative battery cable to battery.

27. Starter Motor—Removal and Installation (693 Only)

a. Removal

1. Disconnect negative battery cable at battery.

2. Raise front end of car and place on jack stands.

3. Disconnect battery lead at starter solenoid terminal.

4. Disconnect neutral safety switch wire and coil feed wire at starter solenoid terminals.

5. Remove spring clip securing wires to solenoid housing.

6. Remove two screws that hold starter motor to flywheel housing.

7. Remove starter motor by pulling it forward and then lowering it straight down.

b. Installation

1. Position starter motor in proper location in flywheel housing.

2. Install two screws holding starter motor to flywheel housing. Tighten screws to 23 foot-pounds.

3. Connect battery lead, coil feed wire, and neutral safety switch wire to starter solenoid terminals.

4. Install spring clip securing solenoid wires to solenoid housing.

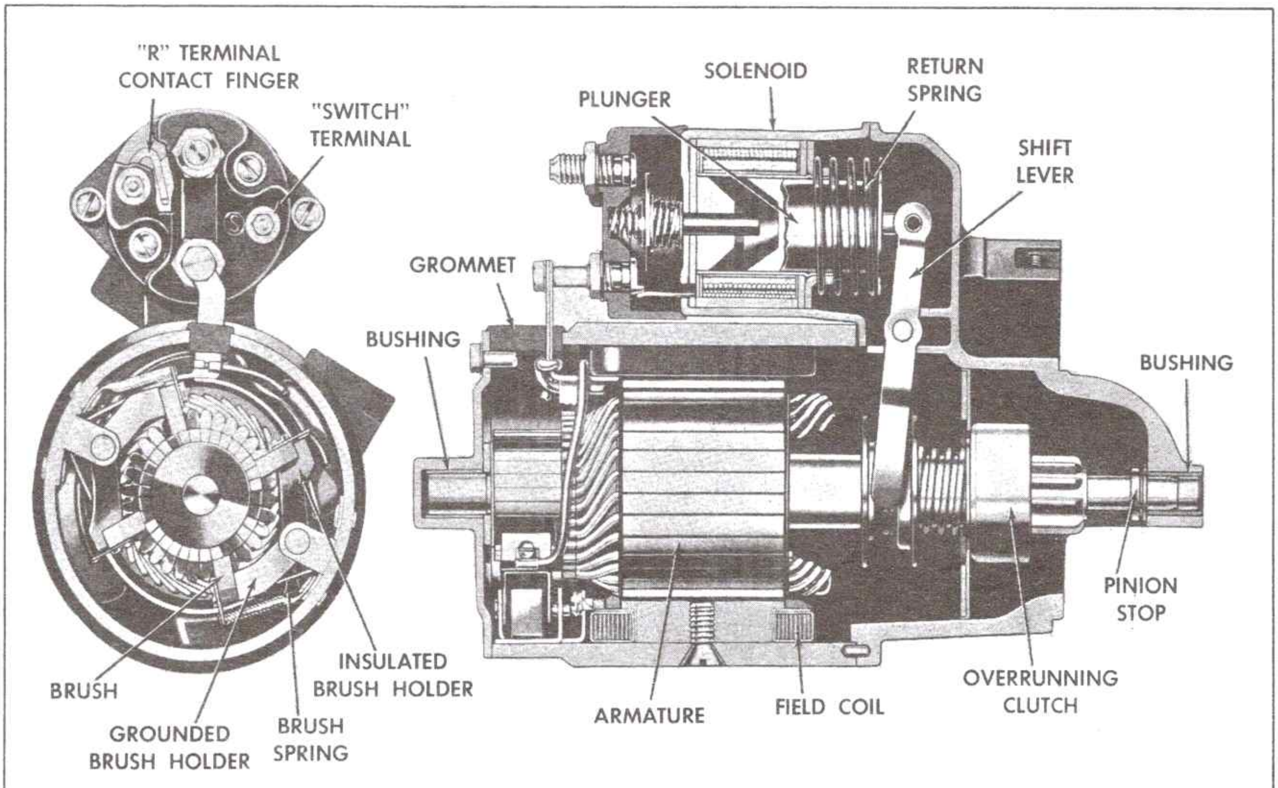


Fig. 6-14 Starter Cutaway View

5. Connect negative battery cable to battery.

28. Starter Motor— Disassembly and Assembly

When the starter motor is disassembled for cleaning and inspection of parts, the overrunning clutch, armature, and fields should not be cleaned in a degreasing tank, or with grease dissolving solvents, since these would dissolve the lubricant in the clutch mechanism and would damge the insulation in the armature and field coils. Worn parts should be replaced, and the commutator should be turned down in a lathe if necessary.

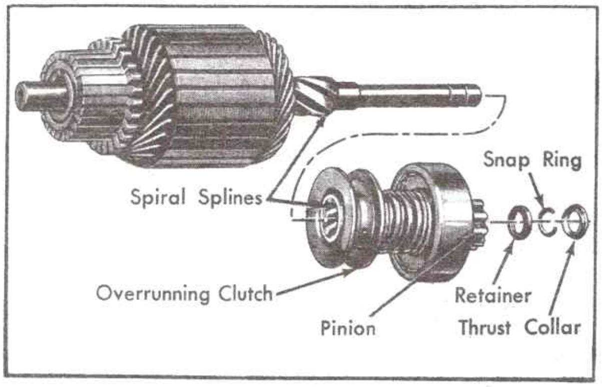


Fig. 6-15 Starter Armature Assembly

a. Disassembly (Fig. 6-14)

1. Disconnect field coil connector from solenoid motor terminal.

2. Remove two screws and lockwashers that hold solenoid switch assembly to starter drive housing and remove solenoid and solenoid return spring by rotating solenoid assembly counterclockwise to release solenoid flange from center frame.

3. Remove two through bolts.

4. Remove commutator end frame and leather brake washer.

5. Remove center frame assembly.

6. Remove snap ring that holds shift lever pivot pin, using snap ring pliers, J-4880, and remove pivot pin from drive housing.

7. Remove plunger and shift lever assembly and armature assembly with overrunning clutch from drive end housing.

8. Remove overrunning clutch from armature shaft as follows:

a. Slide thrust collar off end of armature shaft, Fig. 6-15.

b. Slide a standard 3/8" pipe coupling or 5/8" deep well socket onto shaft so end of coupling or socket butts against edge of retainer, Fig. 6-16. Tap end of coupling or socket with hammer, driving retainer toward armature and off snap ring.

c. Remove snap ring from groove in shaft using pliers or other suitable tool. If snap ring is badly distorted during removal it will be necessary to use a new one when assembling shaft.

d. Slide retainer and clutch assembly from armature shaft.

9. To disassemble solenoid, proceed as follows:

a. Remove two screws with neoprene washers and nut with neoprene washer from switch terminal.

b. Remove contact cover.

c. Remove push rod assembly.

d. Inspect push rod assembly and contact studs for damage or wear. Contact assembly cannot be broken down further and must be replaced as a unit if found defective.

e. To replace contact studs, hold stud while removing nut to be sure stud does not turn.

b. Assembly

1. To assemble solenoid, proceed as follows:

a. Install contact studs, holding studs while tightening nut to be sure stud does not turn.

b. Install push rod assembly.

c. Install contact cover with switch terminal stud through square hole. Secure with two screws with plastic washers and lock nut with plastic washer on switch terminal stud.

2. Assemble overrunning clutch to armature shaft as follows:

a. Lubricate drive end of armature shaft with a few drops of SAE 30W oil.

b. Slide clutch assembly onto armature shaft with pinion outward, Fig. 6-16.

c. Slide retainer onto shaft with cupped surface facing end of shaft, Fig. 6-16.

d. Stand armature on end of a wood surface with commutator down. Position snap ring on upper end of shaft and hold in place with either a piece of wood or a 7/16" socket. Tap socket or block with hammer to force snap ring on end of shaft,

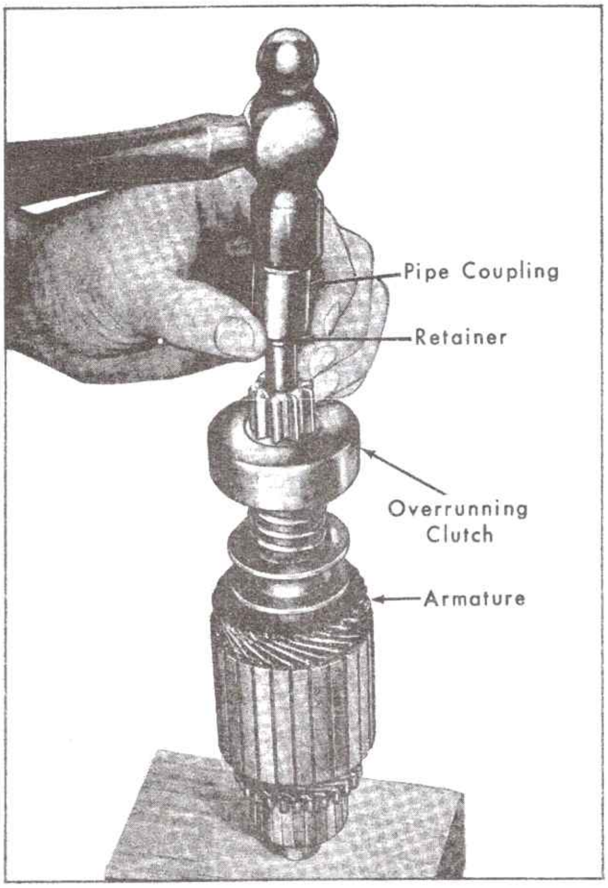


Fig. 6-16 Removing Overrunning Clutch

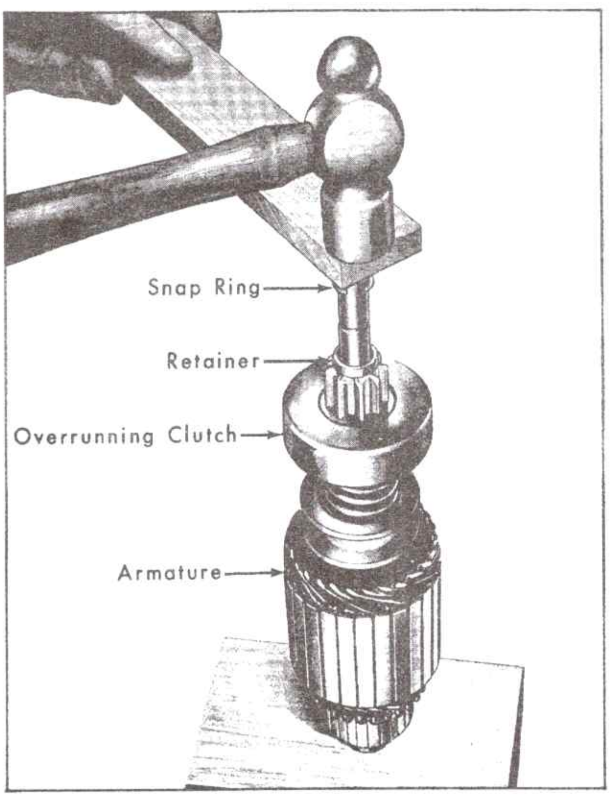


Fig. 6-17 Installing Snap Ring on Shaft

Fig. 6-17. Slide snap ring down to the second groove.

e. Assemble thrust collar on shaft with shoulder next to snap ring, Fig. 6-18.

f. Position retainer and thrust collar next to snap ring. Using two pairs of pliers, grip retainer and thrust collar and squeeze until snap ring is forced onto retainer, Fig. 6-18.

3. Place a small quantity of high melting point grease in drive end housing grease retainer.

4. Position legs of shift lever assembly in grooves of overrunning clutch. Install armature and overrunning clutch assembly into drive end housing, making certain that thrust washer is in place on end of shaft.

5. Install shift lever pivot pin into recess in housing and secure with snap ring, using Snap Ring Pliers, J-4880.

6. Mount starter in a vise and install solenoid return spring and solenoid switch assembly. Secure with two attaching screws and lock washers.

7. Apply a non-hardening sealing compound to area where center frame will contact solenoid case flange.

8. Install center frame assembly on drive end housing by starting assembly over armature, spreading brush holders apart to engage commutator and mating dowel pin on frame with dowel pin hole in drive end housing.

9. Place a small quantity of high melting point grease on bushing in commutator end frame.

10. Place leather brake washer on armature shaft.

11. Slide commutator end frame on shaft and secure with two through bolts.

12. Install field coil terminal connector on solenoid motor terminal, securing with self-tapping screw and star washer.

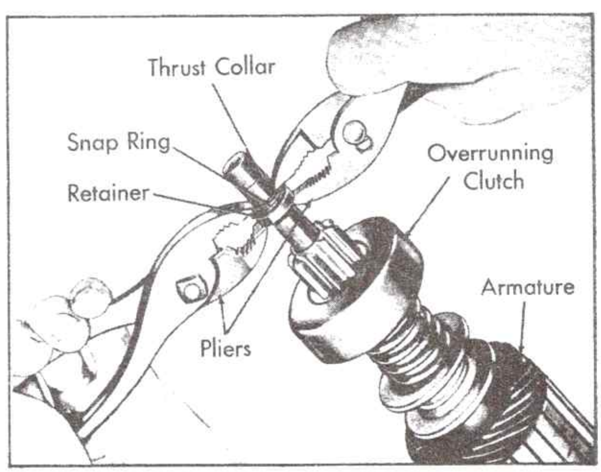


Fig. 6-18 Installing Snap Ring on Retainer

IGNITION SYSTEM

29. Distributor Contact Points

a. Inspection

Remove distributor cap by inserting a screwdriver in upper slotted end of cap retainers, press down and turn until latches are disengaged, Fig. 6-19.

Pitted or oxidized points should be replaced. Contact points with an oily surface should be inspected for a pitted or oxidized condition. The source of oil should be located and corrected. If the points are worn evenly and show a uniform gray surface, they do not need attention, provided the dwell angle is within limits (28° to 32°).

b. Removal

1. Remove two screws that secure rotor cap to distributor and remove cap.

2. Remove capacitor lead and primary lead from nylon insulated connection.

3. Loosen two screws that hold base of contact set assembly in place, and remove contact points.

4. Inspect condition of advance weights. If necessary, add a small amount of cam and bearing lubricant to the advance weights.

c. Installation

1. Position replacement points under the two screws and tighten screws.

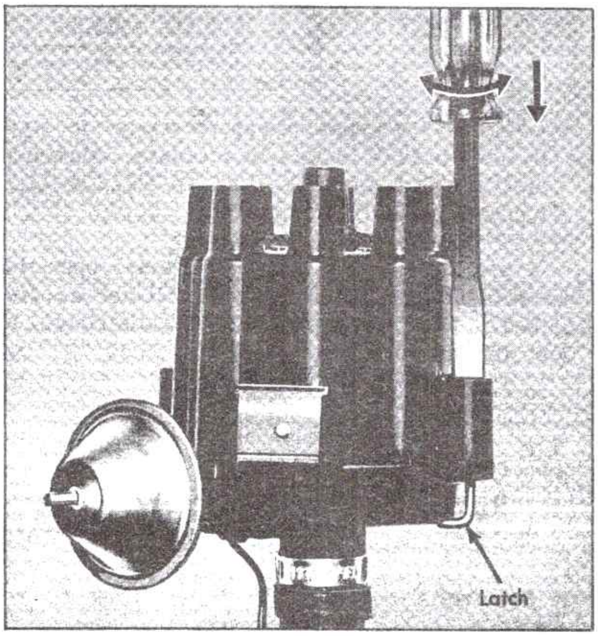


Fig. 6-19 Distributor Cap Removal

2. Install capacitor lead, primary lead and secure with spring clip retainer, Fig. 6-20.

NOTE: Leads must be properly positioned to eliminate interference between cap, weight base, and breaker advance plate.

3. Install rotor cap and secure with two attaching screws. Square and round lugs on the bottom of the rotor must be aligned with corresponding holes found on cam weight base.

4. Position distributor shaft so that contact arm rubbing block rests on one lobe of distributor cam.

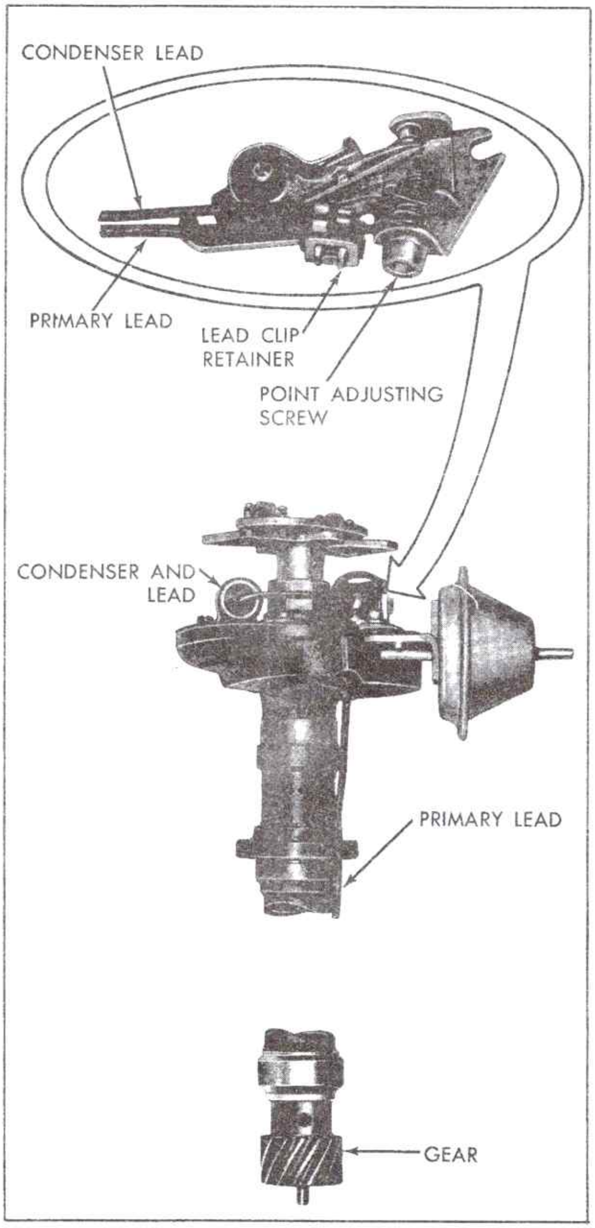


Fig. 6-20 Point Lead Retainer and Drive Gear

5. Insert 1/8 inch Allen wrench into head of the adjusting screw and turn clockwise until points close. Then turn screw counterclockwise 1/2 turn.

6. Replace distributor cap.

7. Adjust contact points as outlined in Section d of this note.

d. Adjustment of Contact Points—Engine Running

Preferred Method:

1. Connect a dwell meter to distributor primary lead.

2. Lift adjustment window and insert Allen wrench into head of adjusting screw, Fig. 6-21.

3. Turn adjusting screw until 30° dwell angle is obtained as measured by dwell meter.

4. Last adjustment should be made by turning clockwise, in order to maintain a more uniform gap.

NOTE: It is unnecessary to check point gap, because of close manufacturing tolerances. The gap will be correct if the dwell angle is 30°.

Alternate Method:

1. Lift adjustment window and insert Allen wrench into head of adjusting screw, Fig. 6-21.

2. Turn adjusting screw in (clockwise) until engine begins to misfire.

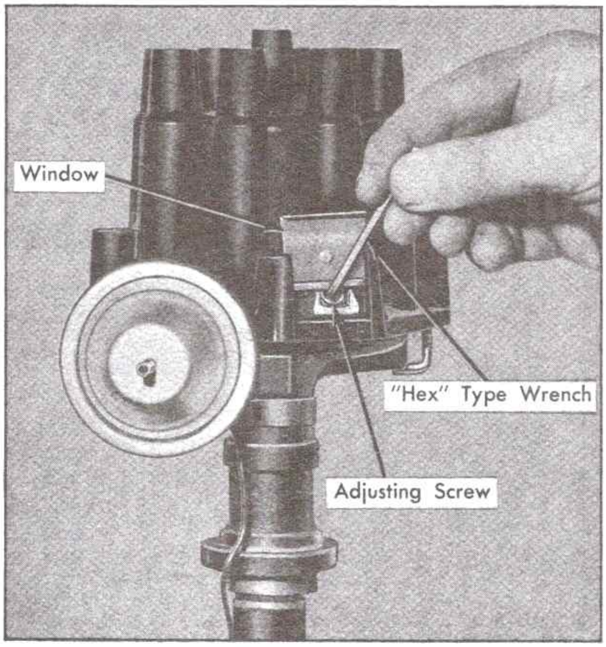


Fig. 6-21 Adjusting Distributor Points

3. Turn wrench 3/4 turn (270°) in opposite direction (counterclockwise), and then turn clockwise 1/4 turn (90°) to obtain proper gap and dwell.

The correct cam or dwell angle setting of the distributor is 28° to 32°.

When replacing contact set assembly, add a small amount of cam and bearing lubricant to the breaker cam.

30. Distributor Test Information

For service departments equipped with distributor testing machines, the information on 1967 distributors is furnished as follows:

Centrifugal Advance	
Distributor Speed rpm	Distributor Spark Advance
400	0° - 4.25°
600	1.75° - 5.75°
800	3.25° - 7.25°
1000	4.75° - 8.50°
1200	6.25° - 10.00°
1400	7.75° - 11.50°
1600	9.00° - 13.00°
2000	12.00° - 16.00°
Vacuum Advance	
Vacuum - Inches Of Mercury	Distributor Degrees
12"	0°
14"	3.00° - 6.75°
16"	5.75° - 9.50°
18"	8.25° - 12.50°
20"	10.25° - 12.75°

NOTE: Vacuum advance starts at 10.00 inches to 12.00 inches of mercury. Maximum distributor advance is 13.25° to 15.25° at 11.25 inches of mercury or greater.

If tests indicate an improperly operating mechanism, disassemble the distributor as described in Note 31b. Reassemble the distributor as described in Note 32a.

31. Distributor Removal and Disassembly

a. Removal

1. Remove distributor cap as shown in Fig. 6-19 and position out of way.

2. Disconnect distributor primary wire from coil.

3. Disconnect vacuum advance hose from vacuum advance unit on distributor.

4. Crank engine until copper contact on top of rotor points directly to No. 1 spark plug.

5. Remove distributor hold down nut and clamp.

6. Lift distributor from engine.

NOTE: The distributor rotor will turn slightly counterclockwise as drive gear becomes disengaged from teeth of camshaft gear. Therefore, when reinstalling the distributor, the rotor should be turned slightly counterclockwise from position of directly to No. 1 spark plug to insure proper engagement. When installed, contact on rotor should point directly to No. 1 spark plug.

b. Disassembly (Fig. 6-22)

1. Remove rotor from end of distributor shaft by removing two attaching screws and lockwashers.

2. Remove two weight springs and both advance weights.

3. Remove pin from gear by driving out with drift punch and hammer.

CAUTION: Distributor gear should be supported in such a way that no damage will occur to distributor shaft when driving pin out.

4. Slide gear off shaft, remove any burrs that may have been caused by removal of pin.

5. Pull shaft with cam weight base assembly from housing.

6. Remove contact point assembly and disconnect primary and capacitor lead clips.

7. Remove capacitor hold-down screw and remove capacitor and bracket from breaker plate.

8. Remove spring retainer and raise breaker plate from housing.

9. To remove the vacuum advance unit, remove two attaching screws, lockwashers, and plate with ground lead.

10. Remove primary lead by prying rubber grommet out of base housing.

11. Remove felt washer from bushing in housing.

NOTE: No attempt should be made to service shaft bushing in housing.

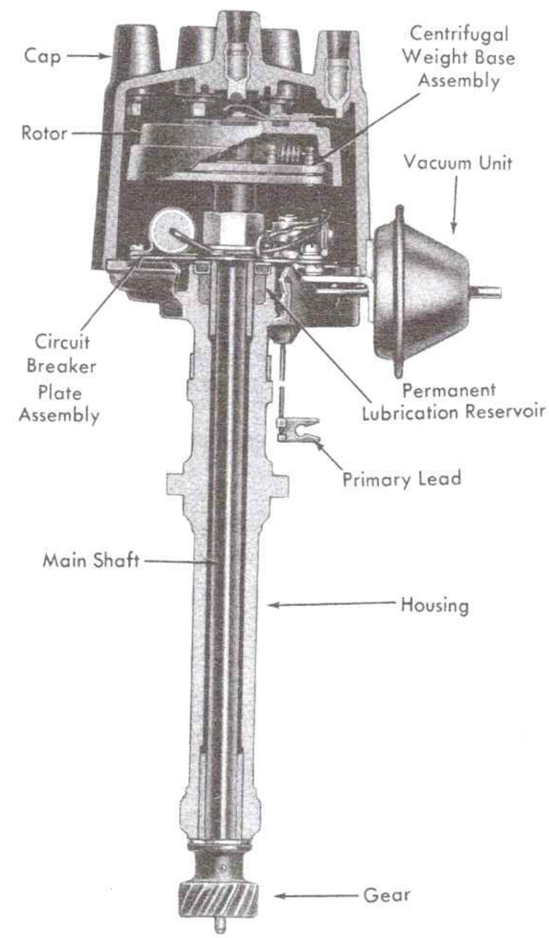


Fig. 6-22 Distributor Cut-Away View

32. Distributor Assembly and Installation

a. Assembly

1. Place felt washer over bushing in housing.

2. Slide primary lead through opening in base of housing and seat grommet in housing.

3. Place vacuum advance unit in space provided in housing and retain in position by installing one screw in hole in mounting arm furthest from advance unit.

4. Secure distributor ground lead to vacuum advance unit with second mounting screw. Primary wire should cross over ground lead.

5. Install breaker plate assembly over bushing so that assembly is positioned over vacuum advance operating arm.

6. Install spring retainer.

7. Place capacitor and bracket in position on breaker plate and secure with one screw.

8. Install contact point assembly.

9. Install capacitor and primary leads as shown in Fig. 6-20.

10. Install shaft with camweight base assembly into housing.

11. Install gear on shaft and secure with pin. Use new pin.

12. Install both advance weights on camweight base and secure with two springs.

13. Install rotor and secure with two screws and lockwashers.

NOTE: The square and round lugs on bottom of rotor must be positioned with corresponding holes on camweight base.

b. Installation

1. Install distributor with copper contact on top of rotor pointing slightly counterclockwise from No. 1 spark plug. As distributor gear meshes with cam gear, rotor will turn slightly clockwise. When distributor is properly installed, rotor should point directly at No. 1 spark plug.

NOTE: If engine has been cranked, remove No. 1 spark plug. Place thumb over port. Crank engine until compression is noticed and continue until No. 1 piston is at top dead center. In this position, the timing mark "O" on the engine front cover lines up with the scribe mark on the harmonic balancer.

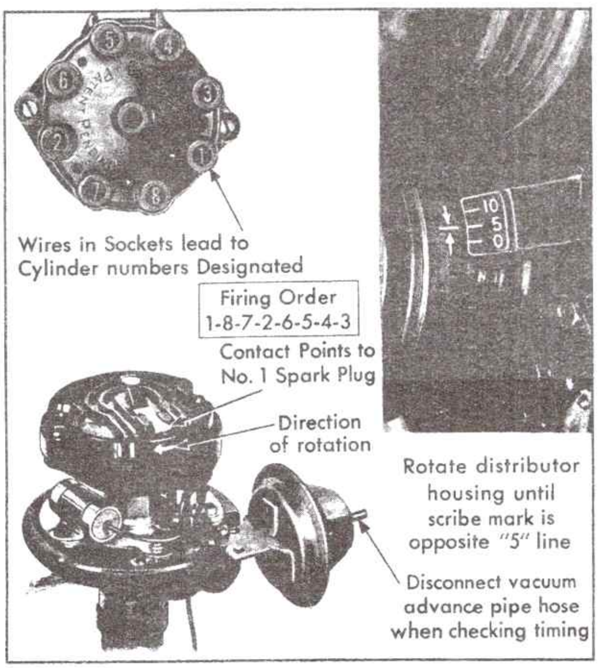


Fig. 6-23 Ignition Timing Adjustment

2. Install distributor hold-down clamp and nut.

3. Connect distributor primary lead.

4. Install distributor cap.

5. Set timing as described in Note 33.

6. Connect vacuum advance hose to vacuum advance unit.

33. Ignition Timing Adjustment

1. Adjust distributor clamp nut to allow distributor to be turned by hand, but without excessive looseness.

2. Disconnect vacuum advance unit hose at distributor and place a piece of tape over end of hose. This is important, as a manifold leak will affect timing adjustments.

3. Disconnect parking brake vacuum hose at diaphragm and place a piece of tape over end of hose to prevent any air leak.

4. Insert an adapter pin alongside No. 1 or No. 6 ignition wire in distributor cap, if spark plug connectors are not available.

5. Connect a suitable timing light to adapter or connector.

NOTE: Make sure that timing marks and scribe mark are clean.

6. Connect tachometer to engine and set parking brake securely. Place transmission selector lever in neutral or park position.

7. Start engine and warm to operating temperature.

8. Set idle speed at 480 rpm (550 on A.I.R. cars only) with transmission selector lever in "DRIVE" position.

9. Observe timing light flashes on harmonic balancer in relation to degree marks on front cover. Rotate distributor so that light flashes when scribe mark and "5" mark are aligned. The "5" mark is five degrees ahead of top dead center, Fig. 6-23.

10. Tighten clamp nut to 18 foot-pounds, and recheck timing to make sure that it did not change.

11. Remove tap from vacuum advance hose and connect hose to vacuum advance unit.

12. Remove tape from parking brake vacuum hose and connect hose to parking brake diaphragm.

13. Disconnect tachometer and timing light, and remove adapter pin or connector from engine.

34. Secondary Efficiency Test

This test provides an overall indication of the performance of the entire ignition system.

1. Turn coil tester selector switch to secondary efficiency position.

2. Connect a tachometer in system.

3. Start engine and set speed at 1,000 rpm.

4. Ground red (positive) lead of Coil Tester, Fig. 6-24.

5. Connect black lead to each spark plug in turn, and note reading on seconday efficiency scale of Coil Test Meter.

6. Readings should be even and in the good band at all plugs.

Secondary efficiency test indications are as follows:

a. Reverse meter reading (off scale to left with leads connected as in steps 4 and 5) indicates coil of wrong polarity; primary wires reversed at coil; or battery connected backwards.

b. Uneven readings at plugs indicates defective spark plug cables or connections, corroded distributor cap towers, uneven spark plug gaps, a

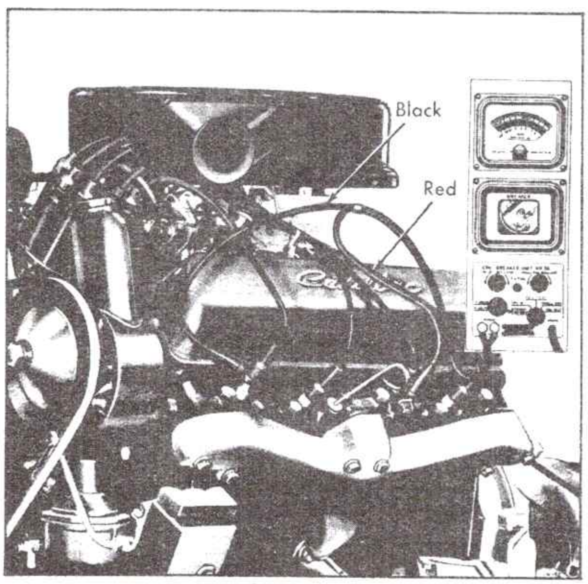


Fig. 6-24 Secondary Efficiency Test

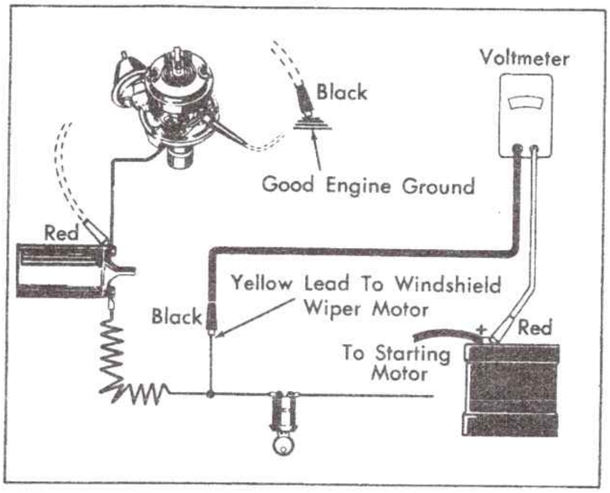


Fig. 6-25 Ignition Primary Circuit Resistance Test

"cocked" distributor cap, uneven compression or faulty spark plugs.

c. Unusually high readings at two or more plugs indicate a cracked distributor cap or insulation breakdown between spark plug cables.

d. Low reading at all plugs indicates excessive resistance in either the primary or secondary circuit, or a weak coil.

e. If the reading is unusually low at one or two plugs, it indicates a ground at the distributor cap, the spark plug cable or the plug itself.

Remove the plug cable and black lead from the plug and note the reading. If the reading improves, the spark plug is grounded or shorted. If the reading does not improve, check plug cable and distributor cap.

35. Ignition Primary Circuit Resistance Test

Excessive voltage drop in the primary circuit will lessen the secondary output of the ignition coil, resulting in hard starting and poor performance.

1. Turn the voltmeter selector switch of the Volt-Ampere Tester to the 4 volt position.

2. Connect test leads as shown in Fig. 6-25.

3. Remove coil secondary wire from distributor and ground.

4. Close breaker points by rotating engine a fraction of a revolution at a time with starting motor.

5. Be sure all lights and accessories are turned off.

6. Turn ignition switch "On". Voltmeter should read not more than .4 volt.

7. Test ignition switch by turning it off and on several times. Voltmeter should record the same reading each time switch is turned on.

NOTE: While switch is being turned on and off, key should be jiggled in switch several times and voltmeter checked for any change in readings.

8. Test all wires for tightness. Move them about and note any change in meter reading.

9. Remove voltmeter leads and place them across the primary wires from coil to distributor as shown by dotted leads in Fig. 6-25. Voltmeter should read less than .1 volt.

NOTE: If voltmeter reading exceeds the specified maximum, isolate the point of this resistance by placing the test leads across each connection and wire in order. The reading across a connection should be proportional to its length as compared to the length and allowable voltage drop of the entire circuit.

36. Ignition Coil Test

The coil in the ignition circuit of an engine acts as a transformer by stepping up battery voltage to a voltage sufficiently high to jump the rotor gap in the distributor and the spark plug gap while the cylinder is under compression. The common causes of coil failure are:

1. High resistance due to corroded connections or broken wires.

2. Short cirucits or breakdown of insulation between turns of the coils and grounds.

3. Breakdown of insulation between the windings and the core or case.

a. Reading Coil Tester Meter

The OHM scale on the coil test unit is to be used for measuring the resistance from 0 ohms to 100,000 ohms.

To calibrate the unit, connect the positive primary and the ground lead clips together. Turn the switch to the "Dwell-Ohm" position.

Adjust the "Dwell-Ohm" regulator until the meter reads on the set line. Disconnect the leads. Connect the unit in which resistance is being measured in series with the test leads. The meter will then indicate the amount of resistance in the unit.

The OHM scale is read from right to left from 0 to 100,000 ohms. From 0 to the first graduation indicates 100 ohms, 50 indicates 500 ohms, 1M indicates 1,000 ohms, 100M indicates 100,000 ohms.

b. Calibrating Coil Tester

To assure an accurate test of the ignition coil, the battery in the tester must have a specific gravity of at least 1.250. The calibration of the Coil Test Unit will vary slightly with long periods of use due to normal wear of the point rubbing block in the breaker assembly.

IMPORTANT: This procedure outlines the proper method of testing the calibration of the Coil Test Unit. The calibration of the unit should be checked at least twice a year and more often if in continuous use.

1. Zero meter to left side of scale, using adjustment on face of meter.

2. Connect blue ground and red primary leads together as shown in Fig. 6-26.

3. Turn master switch "On".

4. Turn switch of Coil Tester Unit to "Dwell-Ohm" position, and use Dwell-Ohm Regulator to adjust meter needle to set line.

5. Disconnect leads and connect the primary leads (red and black) together.

6. Meter now reads the dwell of the Coil Breaker Unit. It should be 6, plus or minus 1/2 division. If meter does not read within these limits, remove cover from Coil Breaker Unit and adjust tester distributor points, with breaker running, until proper reading is obtained.

7. Disconnect test leads and proceed with coil tests.

c. Coil Heating

Before testing any coil, it should be brought to

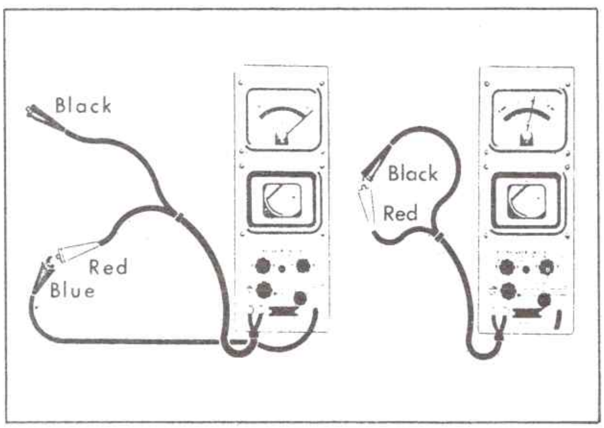


Fig. 6-26 Calibrating Coil Tester

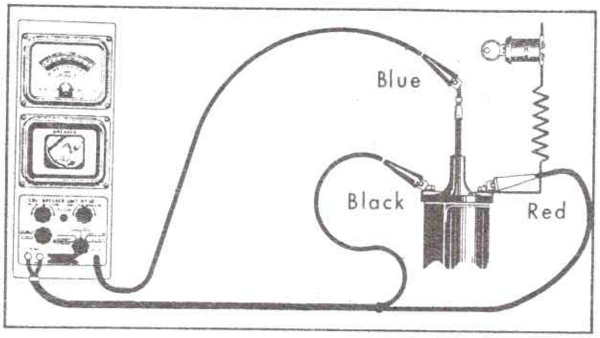


Fig. 6-27 Heating The Coil

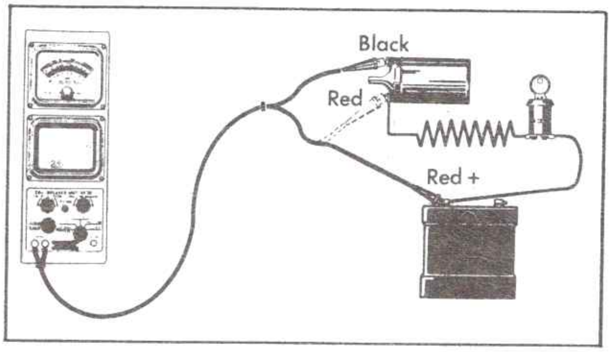


Fig. 6-28 Coil Capacity Test

operating temperature. If the coil is on a car that has been operated for a sufficient period of time to bring the coil to normal operating temperature, the coil does not need additional heating before testing. If, however, the coil is not up to temperature, it must be heated with the Coil Heater as described below.

1. Disconnect primary ignition lead at coil.

2. Remove high tension lead for coil tower and insert adapter lead.

3. Connect coil tester leads as shown in Fig. 6-27.

4. Turn master switch "On".

5. Turn voltage selector switch to 12-volt position.

6. Turn selector switch of Coil Tester to "Coil Heat" position.

7. Heat coil 6 minutes only.

CAUTION: Do not touch leads while tester is in "Coil Heat" position. Turn selector switch to secondary efficiency position before removing clips.

d. Coil Capacity and Secondary Continuity Test

These tests are necessary to determine whether or not the coil is satisfactory for car operation.

1. Disconnect distributor primary wire from coil, and remove high tension lead from coil.

2. Turn master switch "On".

3. Turn voltage selector switch of Coil Tester to the 12-volt position.

4. Be sure all lights and accessories are turned "Off".

5. Turn ignition switch "On".

6. Connect tester leads as shown in solid lines, Fig. 6-28, to include primary circuit in test circuit.

7. Turn switch of Coil Tester Unit to "Coil Set" position, and adjust Coil Set Regulator until meter reads at set point 8.

8. Turn switch to "Coil Test" position. The coil meter should read steady and in the "good" band.

NOTE: If coil tests "bad", reconnect positive tester lead as shown by dotted lines in Fig. 6-28, and readjust Coil Set Regulator until meter reads at set point 8, then retest coil. If the coil tests "good", check primary circuit as described in Note 35. If the primary circuit tests "good", check the ballast resistor wire with an Ohmeter. Resistor value is 1.40 to 1.65 ohms.

9. Now turn switch of Coil Tester Unit to "Dwell-Ohm" position.

10. Connect red and blue leads of Coil Tester Unit together as shown in Fig. 6-26, and, using "Dwell-Ohm" regulator, adjust meter needle to set line.

11. Disconnect red and blue leads and connect leads as shown in Fig. 6-29.

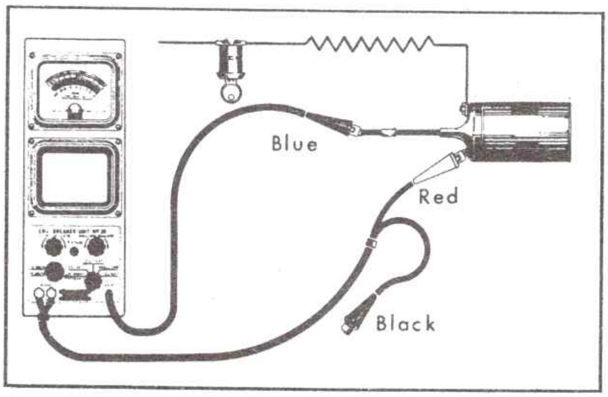


Fig. 6-29 Coil Secondary Test

12. The meter should be between 5,000 and 15,000 ohms resistance.

NOTE: A high reading will indicate an open or high resistance secondary winding while a low reading will indicate shorted winding.

37. Capacitor Tests

a. Preliminary Steps

The capacitor has two important functions: First, it aids in the collapse of the primary field, and second, it prevents arcing and pitting of the breaker points.

The capacitor should be tested for:

1. Series resistance.

2. Correct capacity.

3. Maximum insulation breakdown resistance.

These factors are tested on the Capacitor Tester with one hook-up by turning the Selector Switch to the proper position. First, however, the meter should be calibrated.

1. Connect the Capacitor Tester wire clips together, Fig. 6-30.

2. Turn master switch ON.

3. Turn switch of Capacitor Tester Unit to "Microhm" position and allow unit to warm up.

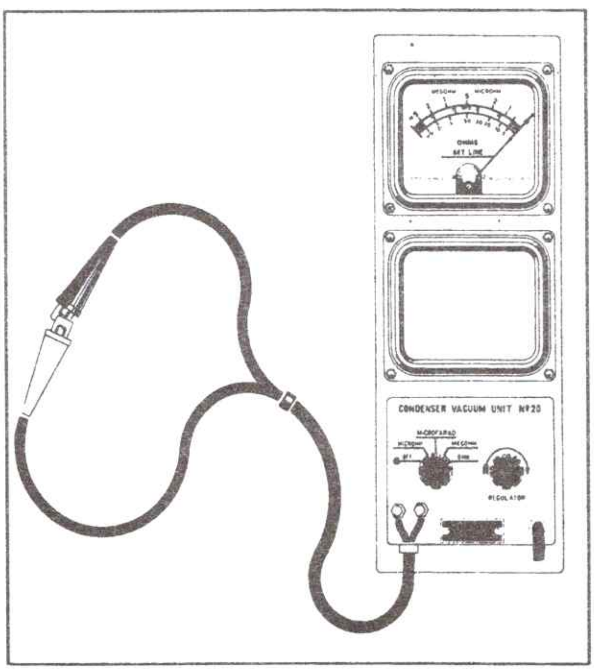


Fig. 6-30 Calibrating Capacitor Tester

4. Turn regulator knob until meter reads on set line.

5. Leave in "Microhm" position and proceed with capacitor tests.

b. Capacitor Tests

Microhm (series resistance) Tests

1. Remove distributor cap.

2. After calibrating tester, leave switch in "Microhm" position and connect red lead to end of primary wire. With points blocked open, connect black lead to side of distributor housing.

3. Meter should read in the blue "Microhm" bar at right of scale.

4. If reading is not in blue bar, move grounded lead of Capacitor Tester to body of the capacitor. If reading improves, capacitor is poorly grounded.

5. Move capacitor pigtail lead. If a deflection of the meter is noted, the lead is making poor contact and capacitor should be replaced.

Microfarad (capacity) Test

1. Turn switch to "Microfarad" position.

2. Read "Microfarad" capacity on center scale of meter.

3. Capacity should be .18 to .23 MFD.

Megohm (insulation) Test

1. Turn switch to "Megohm" position.

2. The meter should read in blue "Megohm" bar at left of scale.

3. If meter reads to right of blue bar, capacitor insulation is leaking.

4. Install distributor cap.

NOTE: When testing capacitor off the car, connect one capacitor test lead to the insulated capacitor terminal and the other test lead to ground on capacitor body.

38. Spark Plug Cleaning and Adjustment

Type 44 spark plugs are used on all 1967 engines.

The condition of the compound in the spark plug cleaner is important. It must be dry, because if moist, it could pack in the space between the insulator tip and shell, allowing only the tip of the

plug to be cleaned. Also, the compound must be sharp to do a good cleaning job. After prolonged use, the particles of compound lose their sharp cutting edges and will not clean properly.

With the spark plug in the cleaner and the air blast turned on, press the cleaner hood down, rocking the plug. Raise the cleaner hood to the air blast position for a few seconds. Rotate the plug in its adapter and repeat the operations until the entire insulator is clean (white). It should be noted here that some spark plugs may have fused deposits on the lower insulator tips that are difficult, if not impossible, to remove. Make sure that all cleaning compound is removed from the plug.

File electrodes flat and set gap to .035 inch. The gap should be checked only with a round wire gage. Use new gaskets when installing plugs, and tighten to 25 foot-pounds.

CHARGING SYSTEM (All Except Commercial Chassis with Optional Generator)

The following procedures apply to the charging system found on all standard and 693 series cars. For 1967 the Commercial Chassis is available with a 130 amp rated generator in conjunction with a transistorized regulator. The circuit for this system is quite different from the one described here. For checking and adjusting procedures on this Optional Commercial Chassis charging system, refer to Notes 53 to 62.

39. Charging Circuit Precautions

When performing any tests or adjustments on the charging circuit there are certain precautions that must be observed or serious damage will result to the electrical equipment.

1. Do not attempt to "polarize" the generator.

2. Do not short across or ground any of the terminals on generator or regulator.

3. Never operate generator on open circuit. Make certain all connections are secure.

4. Make certain ground polarity of battery and ground polarity of generator are the same when installing a battery.

5. When connecting a booster battery, make certain to connect the negative battery terminals together and positive terminals together.

6. When connecting a charger to battery, connect charger positive lead to battery positive terminal and charger negative lead to battery negative terminals.

7. When recharging battery in the vehicle, be sure engine is turned off when battery terminal connections are made. This will prevent arcing at the terminals which could cause an explosion at the battery.

8. Remove battery cap cover and make sure caps are tight before connecting battery cables.

9. Make sure all electrical accessories are turned off when making battery connections.

40. Preliminary Charging Circuit Checks

Visually check the charging circuit for the following:

1. Frayed insulation or wiring.

2. Tightness of mounting bolts.

3. Corroded or loose connections at generator terminals and slip-on connectors at regulator terminals.

41. Analyzing Charging System Troubles

Trouble in the charging system, Fig. 6-31, will usually show up as one or more of the following conditions:

a. Indicator Lamp Operation

The indicator lamp should light when the ignition switch is turned to the "on" position, and the

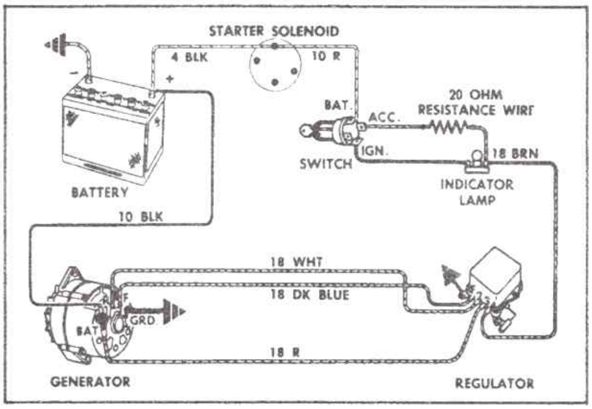


Fig. 6-31 Basic Charging Circuit

engine is not running. Lamp should also glow dimly when the ignition switch is in the "ACC" position. In addition, the lamp may flash brightly when the engine is turned off.

If the indicator light fails to operate as described above, refer to indicator lamp checking procedures, Note 42.

b. Undercharged Battery (Evidenced by Slow Cranking)

Check for the defects listed in Note 13.

If battery is consistently undercharged, refer to Note 42.

c. Overcharged Battery (Evidenced by Excessive Water Usage)

1. Check for a defective battery as covered in Notes 9, 11 and 12.

2. If battery is not defective, voltage regulator setting is probably too high. Refer to Note 51.

42. Testing Indicator Lamp Circuit

a. Lamp does not Light with Ignition in "ON" Position

1. Disconnect wiring harness connector at regulator.

2. Insert jumper lead, J-9782-1, into wiring harness and connect as shown in Fig. 6-32.

3. Turn ignition switch "ON" for not more than 10 seconds.

NOTE: With these connections made for longer than 10 seconds, damage to the 20 ohm resistance wire may result.

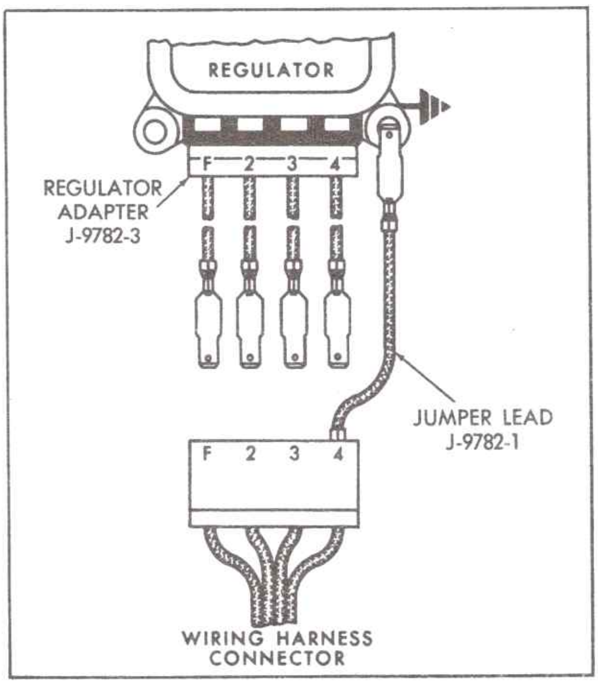


Fig. 6-32 Testing Indicator Lamp Circuit

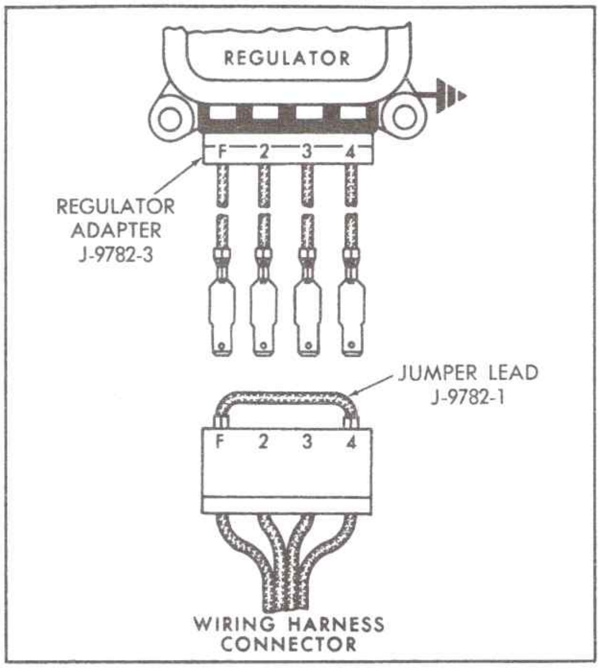


Fig. 6-33 Testing For Opens in Circuit

4. If lamp does not glow, check for a burned out bulb, defective #4 terminal wire, or a defective printed circuit as described in Section 12, Note 17e.

5. If lamp does glow, remove ground and connect as shown in Fig. 6-33.

6. If lamp glows, replace regulator or adjust voltage regulator setting. If lamp does not glow, leave connections as shown in Fig. 6-33 but connect a second jumper wire from generator "F" terminal to ground.

7. If lamp does not glow, "F" terminal lead is open. If lamp glows, field circuit inside generator is open.

b. Lamp Glows when Ignition Switch is "OFF"

1. Unplug connector at rear of generator; if lamp goes out, generator has a shorted diode.

2. If lamp does not go out, make normal connections at generator and remove wiring connector from regulator.

3. If lamp still does not go out, look for a short between #4 lead and #3 lead (or any other lead with battery voltage).

4. If lamp does go out, connect a voltmeter between #2 harness terminal and ground. Any voltage reading indicates that #2 regulator lead is shorted to #3 lead (or another lead with battery voltage). No voltage reading indicates a relay that is mechanically stuck closed.

c. Lamp Glows with Engine Operating at Idle Speed

The possible causes of this condition are covered in Note 43, steps 1, 3, 4, 5 and 6.

NOTE: If defect has been found and corrected at this point, no further checks are necessary.

43. Testing Undercharged Battery Condition

This condition, as evidenced by slow cranking, can be caused by one or more of the following conditions even though the indicator lamp may be operating normally.

1. Check generator drive belt for frayed, worn or loose condition. Adjust belt as outlined in Notes 49 and 50.

2. If a battery defect is suspected, check as described in Notes 9, 11 and 12.

3. Inspect all connections to be sure they are clean and tight, including the slip connectors at the generator, regulator and firewall. Make sure that the regulator is properly grounded. Inspect the wiring harness for grounds. Clean the battery posts and cable clamps to eliminate resistance. Check with ignition switch on as follows:

a. With harness connector attached to regulator, slide test prod into regulator No. 3 terminal, and connect voltmeter from test prod to ground.

b. If reading is zero, circuit is open between this terminal and battery.

c. Connect voltmeter from generator "F" terminal to ground.

d. If a voltage reading is obtained, proceed to Step 4.

e. If reading is zero, connect voltmeter from regulator "F" terminal to ground.

f. If reading is obtained, "F" terminal lead is open.

g. If reading is zero, connect voltmeter from regulator No. 4 terminal to ground.

h. If reading is obtained, replace regulator or adjust regulator voltage setting.

i. If reading is zero, circuit is open between regulator No. 4 terminal and Ignition Switch.

4. Connect voltmeter from regulator No. 4 terminal to ground. Turn Ignition Switch to "ACC" position. If reading is zero, resistor connected to "ACC" terminal is open.

5. If the indicator lamp operates normally, checks need not be made on the field relay; go to Note 44. However, if the indicator lamp fails to go out with the generator in operation, check the field relay as follows:

a. Connect a voltmeter from regulator No. 2 terminal to ground.

b. Operate engine slightly above idle speed.

c. If voltmeter reads 5 volts or above, and the indicator lamp fails to go out, replace regulator.

d. If reading is below 5 volts, connect voltmeter from generator "R" terminal to ground.

e. If reading now is 5 volts or above, lead between generator "R" terminal and regulator No. 2 terminal is defective.

f. If reading is still below 5 volts, proceed to Note 44.

44. Testing Overcharged Battery Condition

An overcharged battery, as evidenced by excessive water usage, can be caused by:

1. Defective Battery: If a defective battery is suspected, check it as described in Notes 9, 11, and 12.

2. Poor Circuit Connections: Inspect all connections to make sure they are clean and tight, particularly the circuit between the battery and regulator No. 3 terminal, and the regulator ground.

3. High Voltage Regulator Setting: If no circuit defects are found, yet the battery remains overcharged, proceed to Note 51 - "Adjusting Voltage Regulator Setting."

45. Generator Output Test

1. Disconnect negative battery cable.

2. Disconnect battery lead from "BAT" terminal of generator.

3. Connect ammeter between disconnected lead and "BAT" terminal of generator (Fig. 6-34).

NOTE: If car is equipped with air conditioning the red A/C feed wire should be secured with the lead that was disconnected in step 2.

4. Connect positive lead of voltmeter to "BAT" terminal of generator and negative lead to ground, Fig. 6-34.

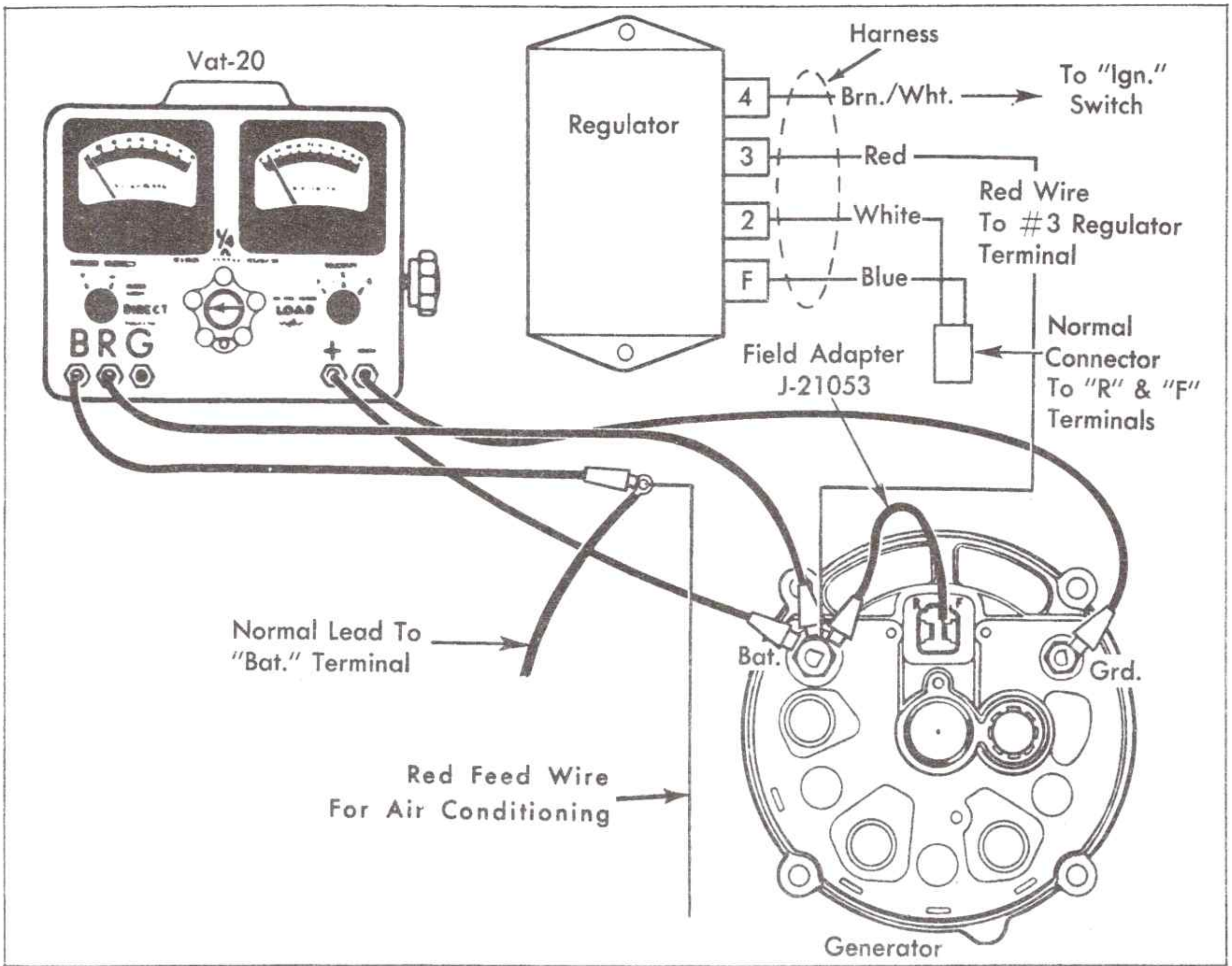


Fig. 6-34 Generator Output Test Leads

5. Remove wiring connector from back of generator, Fig. 6-34.

6. Connect jumper wire J-21053 from "BAT" terminal of generator to "F" terminal on back of generator, Fig. 6-34.

7. Reconnect negative battery cable.

8. Start engine, turn on high beam headlights and place Automatic Climate Control selector lever in second AUTOMATIC position.

9. Slowly increase engine speed to 2,000 RPM and note ammeter reading.

NOTE: As engine speed is increased, do NOT allow voltage to exceed 16 volts. If voltage reaches 16 volts before 2,000 RPM, stop. Read ammeter at this point.

10. If output is within 10 amperes of rated output as stamped on generator housing for non-air conditioned cars, or within 15 amperes of rated output for air conditioned cars, generator is in satisfactory condition, proceed to Note 51.

If ammeter fails to read as specified above, generator must either be repaired and retested or replaced before voltage regulator settings are attempted.

46. Generator Removal and Disassembly (All Except Commercial Chassis with Optional Generator)

For 1967 the Commercial Chassis is available with a 130 amp rated generator. For removal, disassembly, testing, assembly and installation of this unit, refer to Notes 53 through 62.

a. Removal

1. Disconnect battery ground cable at battery.

2. Disconnect wires and multiple connector from generator.

3. Remove generator link adjusting screw.

4. Remove front nut and washer from locating stud on exhaust manifold.

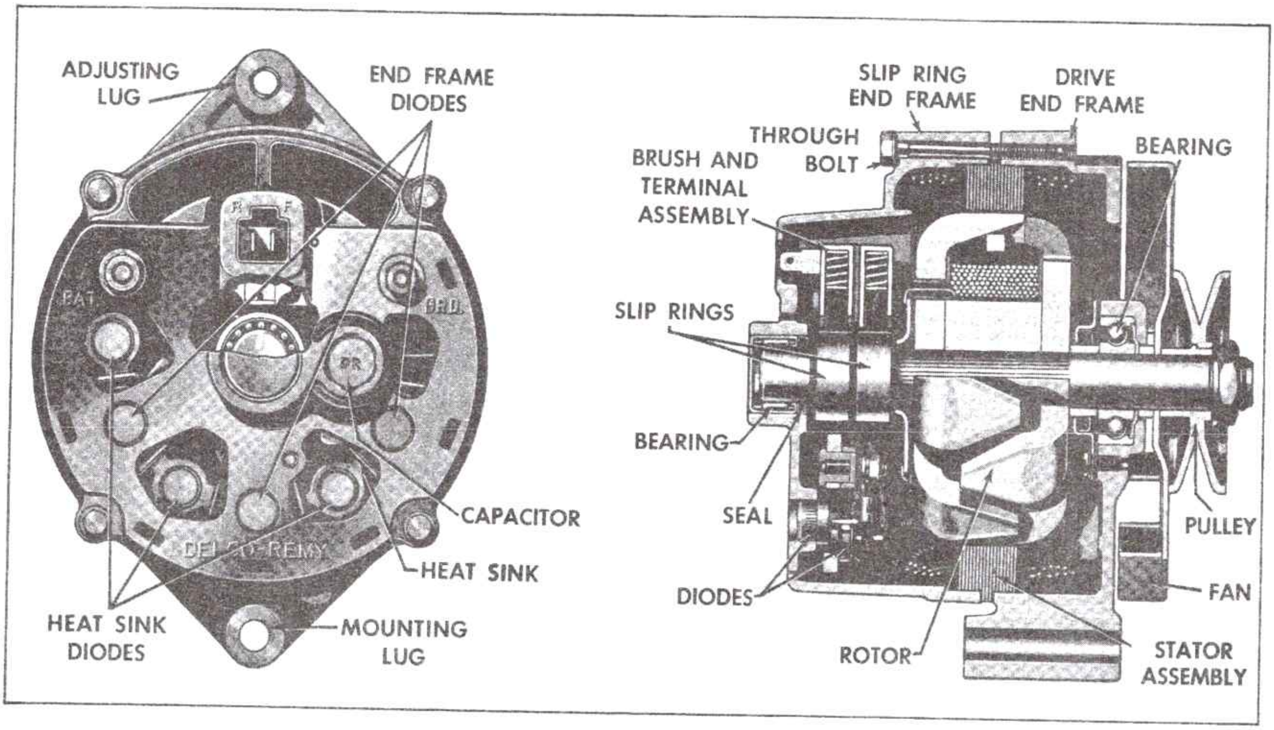


Fig. 6-35 Generator Cut-Away View

5. Disconnect drive belt from generator pulley.

6. Remove two screws that hold generator support bracket to exhaust manifold.

7. Position generator away from support brace and slide generator with support bracket off locating stud on manifold.

b. Disassembly

1. Remove four through bolts securing drive end frame to slip ring end frame, Fig. 6-35.

2. Separate drive end frame, with rotor, from slip ring end frame. Be sure that stator frame stays with slip ring end frame.

CAUTION: Brushes should be cleaned as soon as possible to prevent grease from soaking into brushes.

3. Remove brush springs, which will now be loose.

4. Cover roller bearing in slip ring end frame with a piece of tape to prevent entry of dirt or other foreign material.

5. Insert a 5/16 inch Allen wrench into hex head hole in pulley end of rotor shaft and loosen pulley retainer nut.

6. Remove pulley retainer nut, washer, pulley, fan and small outer collar from rotor shaft.

7. Separate drive end frame from rotor shaft and remove large inner collar.

8. Remove three nuts and lockwashers that hold diode and stator leads to heat sink, disconnect leads and separate stator from slip ring end frame, Fig. 6-36.

9. Remove two screws and flat washers that hold brush holder assembly to slip ring end frame

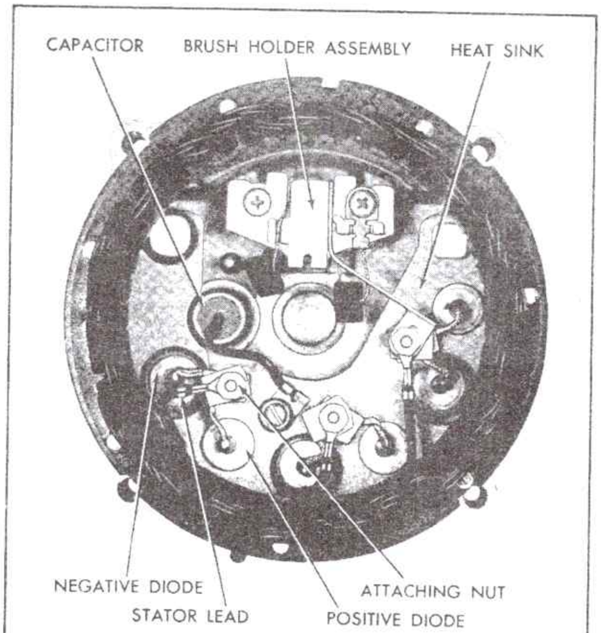


Fig. 6-36 Slip Ring End Frame

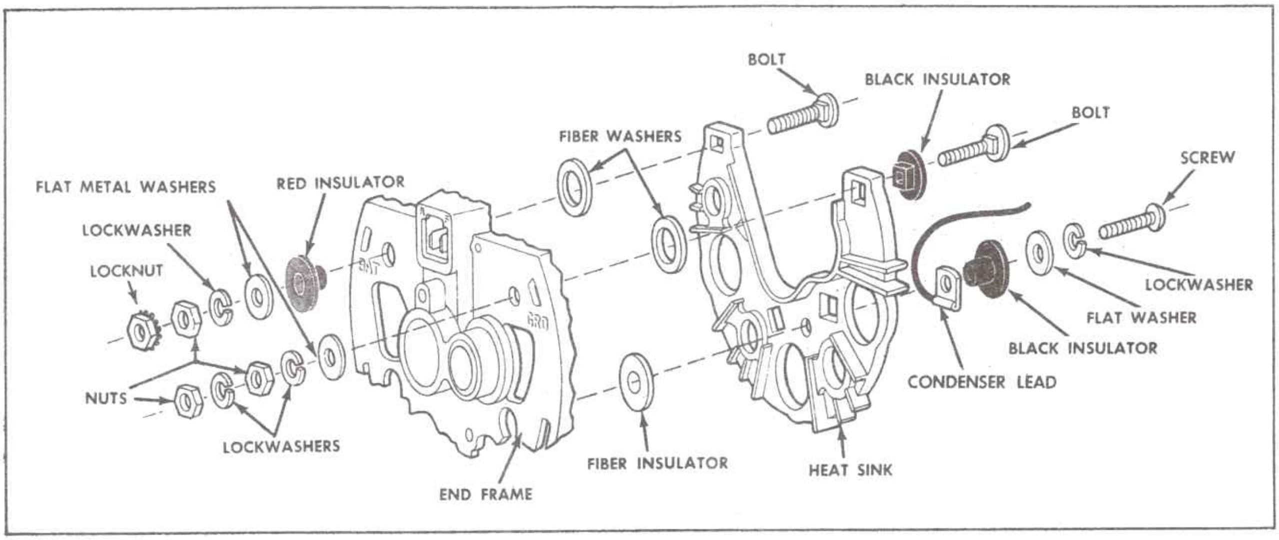


Fig. 6-37 Heat Sink Disassembled

and remove brush holder assembly from end frame.

10. The heat sink should not be removed unless visual inspection indicates need for replacement. Refer to Note 47b.

47. Generator Components, Inspection, Testing and Replacement (All Except Commercial Chassis with Optional Generator)

a. Brush Holder Assembly

1. Inspect brush springs for any evidence of damage or corrosion.

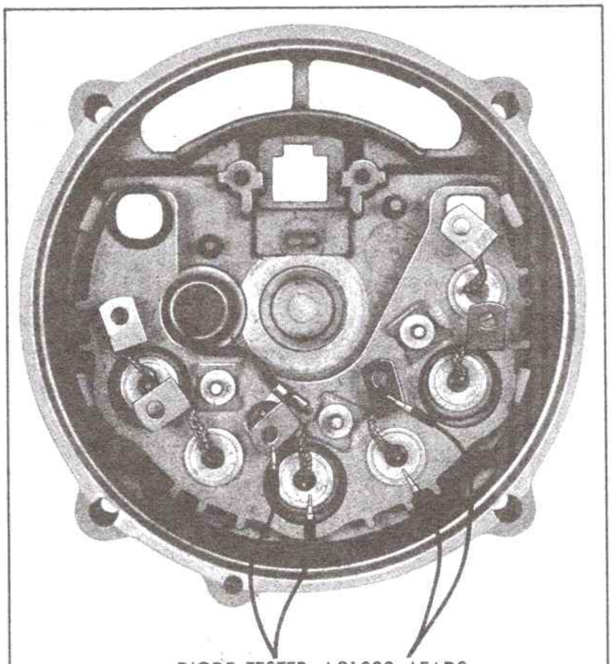


Fig. 6-38 Diode Checking

2. Inspect brushes for signs of wear and brush pigtails for signs of fraying.

3. Inspect brush holder for signs of cracks.

NOTE: The brush holder assembly, including brushes, is serviced as an assembly.

b. Heat Sink

1. Inspect heat sink for signs of cracks.

2. If necessary, replace heat sink by removing two terminal bolts and capacitor lead retaining screw. Carefully note arrangement of parts so that BAT and GRD terminals are replaced in the same order, Fig. 6-37.

c. Diodes

1. Make sure that stator is disconnected and that each diode lead is disconnected.

2. Connect Test Light, J-21008, leads across each diode, first in one direction and then in the other, Fig. 6-38.

NOTE: When performing these tests, use only Test Light, J-21008.

3. If lamp lights in both directions, or fails to light in either direction, diode is defective. When checking a good diode, lamp will light in only one direction.

4. If necessary to replace diode, support inside of end frame or heat sink with Diode Support, J-9717-2, and press out diode with Diode Remover, J-9717-1, and a vise, Fig. 6-39.

CAUTION: Do not remove diode by striking with a hammer as shock may damage other diodes.

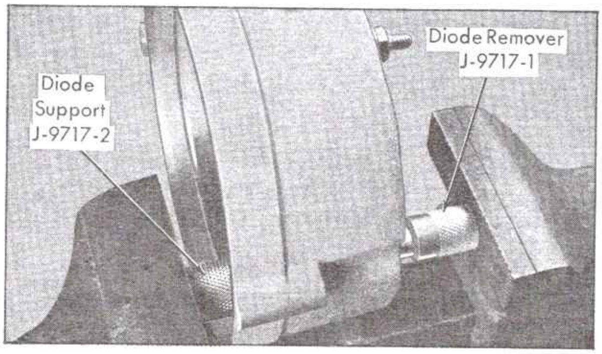


Fig. 6-39 Diode Removal

5. Support outside of end frame or heat sink around diode hole with Diode Support, J-9717-2, and press new diode into position with Diode Installer, J-9600-2, and a vise, Fig. 6-40.

6. Test new diode as described in steps 2 and 3.

d. Capacitor

Once the capacitor has been removed, the case will become deformed and the capacitor will not fit tightly if re-installed. For this reason a capacitor should not be removed unless defective.

1. Test capacitor while it is mounted in the slip ring end frame. Correct capacity is .5 microfarad plus or minus .1 microfarad.

2. If necessary to replace capacitor, remove screw securing lead to heat sink and remove lockwasher, flat washer, and black insulator.

3. Press capacitor out from outside of end frame toward inside using Diode Remover, J-9717-1, and a vise.

CAUTION: Do not remove capacitor by striking with a hammer as shock may damage diodes.

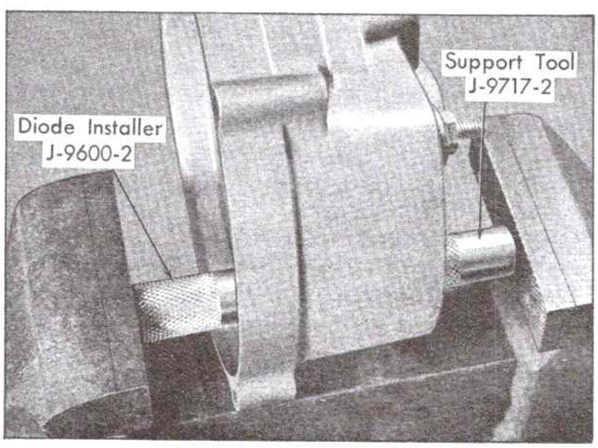


Fig. 6-40 Diode Installation

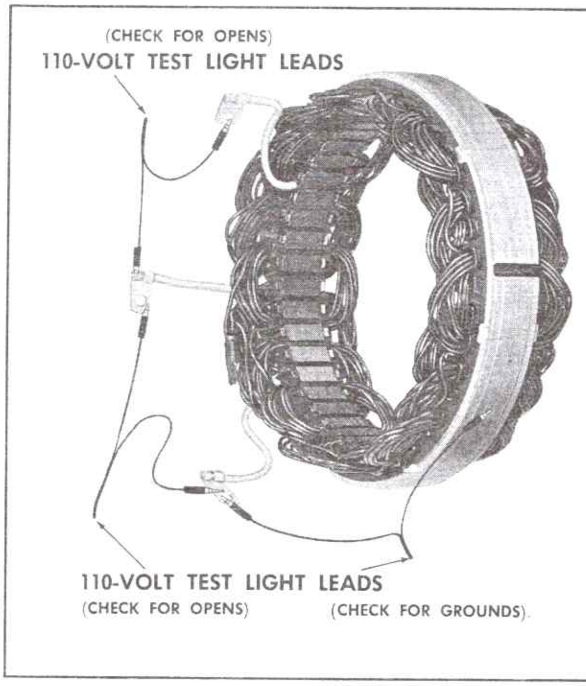


Fig. 6-41 Stator Checking

4. Press new capacitor in from inside end frame toward outside, using Diode Installer, J-9600-2, and a vise.

5. Reassemble capacitor lead to heat sink carefully noting arrangement of parts, Fig. 6-37 and secure lead to heat sink with attaching screw.

e. Stator

1. Make sure stator leads are disconnected.

2. Check stator windings for grounds or opens, using a 110-Volt Test Lamp, Fig. 6-41.

GROUNDS - If test lamp lights when connected from any lead to stator frame, windings are grounded.

OPENS - If lamp fails to light when successively connected between each pair of stator leads, windings are open.

SHORTS - A short circuit in the stator windings is difficult to find due to the low resistance in the windings. However, if all other electrical checks are normal and generator still fails to supply rated output, it is an indication that the stator windings are probably shorted.

3. If necessary to replace stator, it must be replaced as a unit.

f. Rotor

1. Test rotor for grounds or opens with the aid of 110-Volt Test Lamp, Fig. 6-42.

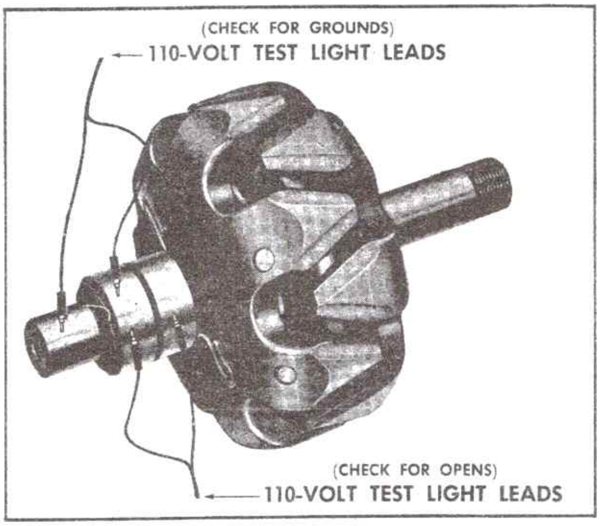


Fig. 6-42 Rotor Checking

GROUNDS - Connect test lamp from either slip ring to rotor shaft or rotor poles. If lamp lights, field winding is grounded.

OPENS - Connect the leads of the test lamp to each slip ring. If lamp fails to light, winding is open.

SHORTS - Connect a 12-volt battery and ammeter in series with slip rings and note ammeter reading. If above 2.6 amperes, it is an indication that a shorted winding exists.

2. Inspect slip rings. If they are dirty, they may be cleaned and finished with 400 grain, or finer, polishing cloth. Spin rotor in a lathe to insure that slip rings are cleaned evenly with no flat spots.

3. If necessary, slip rings that are out of round or rough should be turned in a lathe to .001 inch maximum indicator reading. Finish with a 400 grain or finer polishing cloth.

4. If necessary replace rotor as a unit.

g. Ball Bearing—Drive End Frame

1. Check ball bearing in drive end frame for roughness.

2. If necessary to replace bearing, remove three cap screws that hold bearing retainer plate to end frame and remove retainer plate and gasket. Discard gasket.

NOTE: Inspect felt seal in retainer plate. If seal is hardened or excessively worn, discard retainer plate.

3. Support inside of end frame with a hollow cylinder to prevent breakage of end frame.

4. Press bearing and lubricant retainer out of end frame, using a collar or tube that just fits bore of end frame. Press from outside of end frame toward inside. Discard bearing and lubricant retainer.

5. Install new bearing and new lubricant retainer in bore of end frame. Make sure bearing is square in bore of end frame.

6. Press bearing in from inside of end frame toward outside, using a collar or tube that just fits over bearing outer race.

7. Saturate felt seal in retainer plate with engine oil.

8. Install retainer plate using new gasket on end frame and secure with three attaching screws. Tighten screws to 28 inch-pounds. Bend edges of retainer screws over sides of retainer plate to prevent screws from becoming loose.

h. Roller Bearing—Slip Ring End Frame

The roller bearing in the slip ring end frame should be replaced if its lubricant supply is exhausted. No attempt should be made to relubricate and re-use the bearing.

1. If necessary to replace bearing, support inside of end frame with a hollow cylinder to prevent breakage of end frame.

2. Press bearing and seal retainer out of end frame, using a tube or collar that just fits bore of end frame. Press from outside of end frame toward inside. Discard bearing and seal retainer.

3. Install new bearing in bore of end frame from outside of end frame toward inside. Make sure bearing is square in bore.

4. Support inside of end frame with a hollow cylinder to prevent breakage of end frame.

5. Place a flat plate over bearing and press in until bearing is flush with outside of end frame.

6. Saturate felt seal in new seal retainer with engine oil and install seal retainer in bore of end frame. Press retainer in until it bottoms against bearing.

48. Generator Assembly and Installation (All Except Commercial Chassis with Optional Generator)

a. Assembly

1. Install brush holder assembly on slip ring end frame and secure with two screws and flat washers. Tighten screws to 12 inch-pounds.

2. Install stator into slip ring end frame with three stator leads projecting near connecting terminals.

3. Connect end frame diode leads, heat sink diode leads, and stator leads to their respective terminals, and install retaining nuts and lockwashers.

4. Clean brushes with soft dry cloth to remove any traces of lubricant.

5. Install brush springs and brushes into brush holder and insert a straight wire or pin through hole in end frame and holes in bottom of brush holder. This will hold brushes until rotor is assembled into end frame.

6. Install large inner collar over rotor shaft.

7. Install drive end frame over rotor shaft.

8. Install small outer collar, fan, and pulley over rotor shaft with hub of pulley facing downward, and secure with lockwasher and nut.

9. Insert a 5/16 inch Allen wrench into hex head hole in end of rotor shaft and tighten nut to 55 foot-pounds.

10. Clean slip rings with a soft dry cloth to remove any trace of lubricant.

11. Position the two end frames in relation to each other as shown in Fig. 6-35. Adjusting lug should be directly above "R" and "F" terminals.

12. Install rotor, complete with drive end frame, into slip ring end frame, and retain with four through-bolts.

13. Remove wire or pin projecting through rear of slip ring end frame, allowing brushes to seat on slip rings.

b. Installation

1. Slip generator over locating stud on exhaust manifold and loosely install generator link adjusting screw.

2. Install support bracket with attaching cap screws over locating stud on manifold and loosely install screws.

3. Install washer and nut over locating stud and secure finger tight.

4. Tighten support bracket-to-manifold screws to 18 foot-pounds.

5. Install drive belt on generator pulley.

6. Adjust generator drive belt as described in Note 49 or 50.

7. Connect wires and multiple connector to generator.

8. Connect battery ground cable at battery.

49. Generator Belt Adjustment (All Except 693)

On dual belt drives, if it is necessary to replace one belt, replace both belts so that equal tension is taken by each belt.

a. Checking Belt Tension

1. Place Belt Tension Gage, J-7316, on drive belt mid-way between pulleys.

2. Check gage reading. Proper belt tension for a used belt is 55 to 70 foot-pounds and for a new belt, 100 foot-pounds. If belt tension is incorrect, adjust belt as described in part b of this Note.

b. Adjusting Belt Tension

1. Loosen generator link adjusting screw and nut over locating stud.

2. Move generator as required until correct belt tension is obtained on gage.

3. Tighten generator link adjusting screw to 10 foot-pounds.

4. Tighten nut on locating stud to 18 foot-pounds.

50. Generator Belt Adjustment (693 Only)

On dual belt drives, if it is necessary to replace one belt, replace both belts so that equal tension is taken by each belt.

a. Checking Belt Tension

1. Place Belt Tension Gage, J-7316, on either drive belt mid-way between pulleys.

2. Check gage reading. Proper belt tension for a used belt is 55 to 70 foot-pounds and for a new belt, 100 foot-pounds. If belt tension is incorrect, adjust belt as described in part b of this Note.

b. Adjusting Belt Tension

1. Loosen generator link adjusting screw.

2. Move generator as required until correct belt tension is obtained on gage.

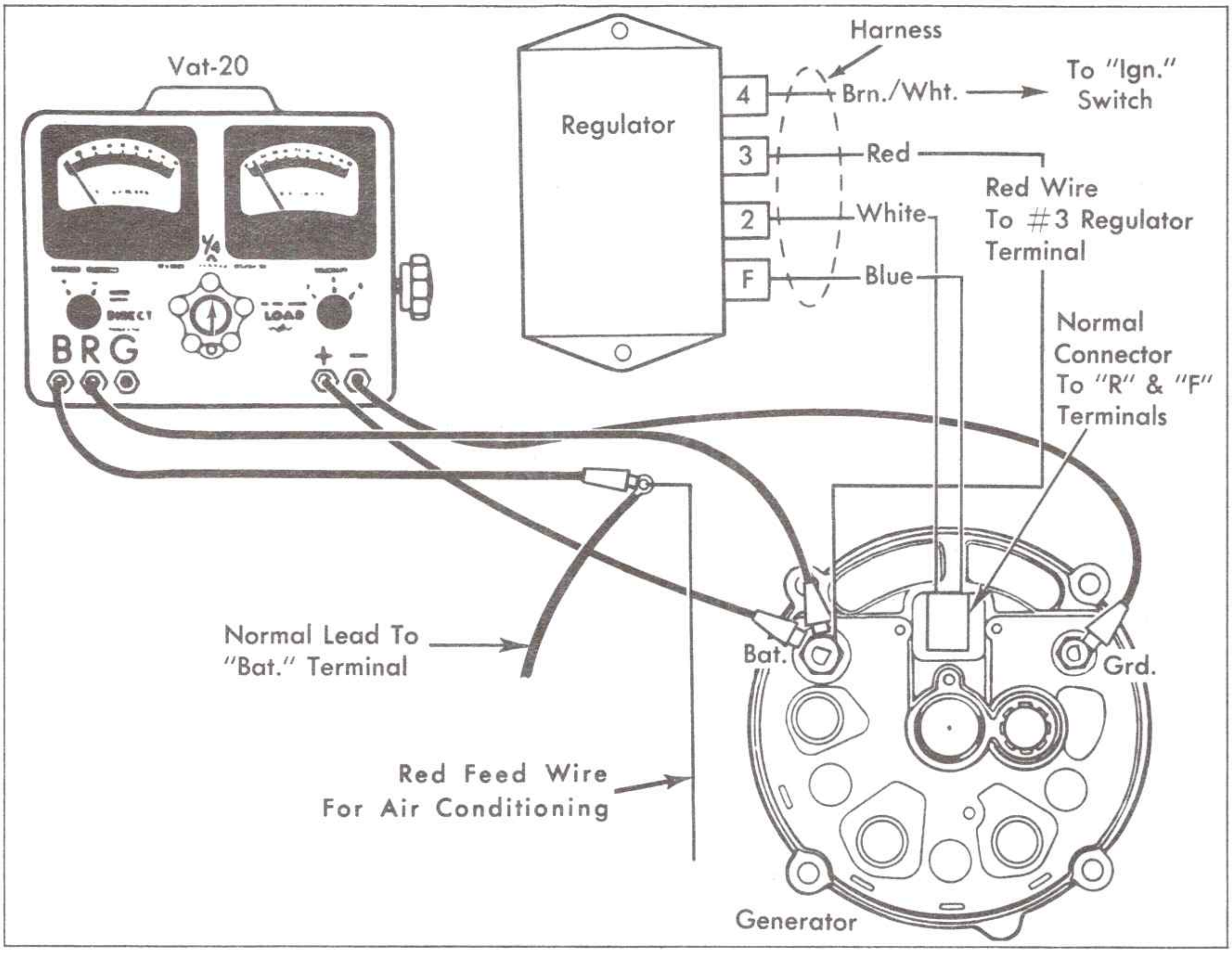


Fig. 6-43 Voltage Regulator Test Leads

3. Tighten generator link adjusting screw to 10 foot-pounds.

51. Regulator Tests and Adjustments (All Except Commercial Chassis with Optional Generator)

The voltage regulator unit limits voltage to the value to which the unit is adjusted. Tests should be made at normal operating temperature.

a. Checking Voltage Regulator Setting

1. Disconnect negative battery cable.

2. Disconnect battery lead from "BAT" terminal of generator.

3. Connect ammeter between disconnected lead and "BAT" terminal of generator, Fig. 6-43.

NOTE: If car is equipped with air conditioning the red A/C feed wire should be secured with the lead that was disconnected in step 2.

4. Connect positive lead of voltmeter to "BAT" terminal of generator and negative lead to ground, Fig. 6-43.

5. Reconnect negative battery cable.

6. Start engine and allow to idle for 15 minutes to establish regulator operating temperature.

7. Move load control to 1/4 ohm position with engine at idle.

CAUTION: If 1/4 ohm is applied at higher than idle speed, an incorrect voltage reading will result.

8. Cycle the regulator by detaching then reconnecting the harness connector at the regulator.

9. Bring engine speed up to 2000-2200 rpm; note ambient temperature and voltage setting. Compare with specifications in chart on Page 6-41.

10. Connect a jumper wire from the base of the regulator unit to a good ground and note voltage reading.

If voltage reading changes when regulator base is temporarily grounded, regulator is poorly grounded and voltage reading is inaccurate. Correct situation before taking final voltage reading.

Regulator Ambient Temperature	Voltage	
	Low	High
185°F	13.1	13.9
165°F	13.2	14.0
145°F	13.4	14.2
125°F	13.5	14.4
105°F	13.7	14.6
85°F	13.8	14.8
65°F	13.9	15.0

11. If regulator ground is all right and a voltage reading outside the specified operating range is observed, an incorrect voltage regulator setting or defective regulator unit is indicated. Proceed to part b for adjusting procedures.

A voltage reading within the specified range indicates a properly functioning charging system. Some systems may require a finer adjustment within this range. See part b below. If the fine adjustment fails to result in a proper battery condition over a reasonable period of time, and the generator continues to pass the output test, the voltage regulator should be replaced.

b. Adjusting Voltage Regulator Setting

1. With tester lead connection still as in part a, Fig. 6-43, proceed as follows:

2. Detach regulator harness connector, remove cover, reconnect harness connector.

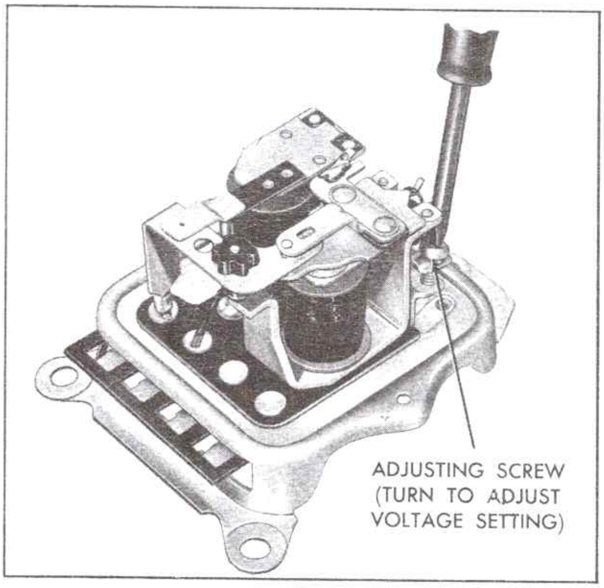


Fig. 6-44 Adjusting Voltage Setting

3. Turn adjusting screw as shown in Fig. 6-44.

4. For undercharged battery raise setting to upper part of specification range.

5. For overcharged battery lower setting to lower part of specification range.

NOTE: Always make final setting by turning screw clockwise. This insures that spring holder will be against head of screw. If it is necessary to turn screw counterclockwise, turn until screw head is approximately 1/8 inch above adjusting bracket, then pry holder up against screw head and turn clockwise to make setting.

6. After making setting, cycle by disconnecting then reconnecting harness connector at regulator.

7. Operate engine at 2000-2200 rpm and note setting. Re-adjust if necessary. Always cycle (Step 6) before reading final voltage setting.

8. This procedure has adjusted the setting while operating on the upper or shorting contacts. Proceed to adjust the setting in the lower or series contacts as follows.

9. Slowly decrease engine speed from the 2000-2200 rpm value and observe voltmeter. When operation changes from upper to lower contacts, voltmeter reading should suddenly decrease a few tenths of a volt. Compare difference in voltage readings with specifications.

10. To decrease the difference in voltage between upper and lower contact operation, turn the nylon nut, Fig. 6-45 clockwise a slight amount. To increase the difference, turn nylon nut counterclockwise. If this adjustment is made, the voltage setting must be re-checked as covered in Steps 1 through 9.

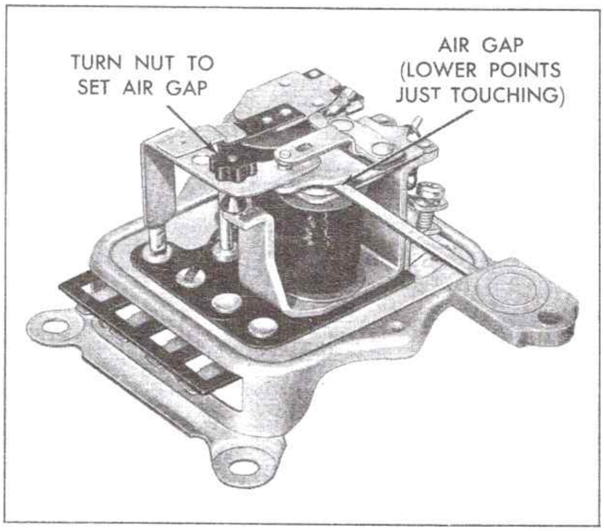


Fig. 6-45 Checking Voltage Regulator Air Gap

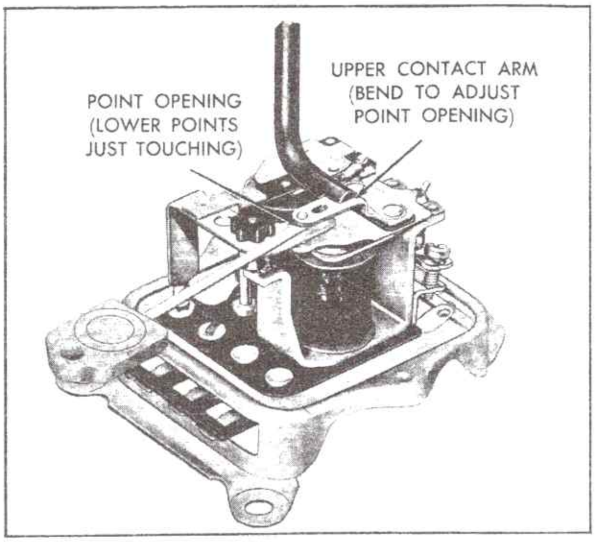


Fig. 6-46 Checking Voltage Regulator Point Opening

CAUTION: Do not attempt to check regulator except when mounted on car and properly grounded. Operation without ground will destroy regulator.

11. If voltage operation is erratic, and if the regulator cannot be adjusted to a steady value, replace the regulator. Do not attempt to clean the contact points.

NOTE: Always remove harness connector at regulator when removing or replacing cover to avoid accidental grounds and consequent damage to regulator.

52. Regulator Mechanical Adjustments (Off Car) (All Except Commercial Chassis with Optional Generator)

a. Voltage Regulator—Point Opening

1. With lower set of contact points just touching, insert a .014 inch feeler gage between upper set of contact points, and adjust by bending upper contact arm, Fig. 6-46.

CAUTION: Be careful not to bend hinge.

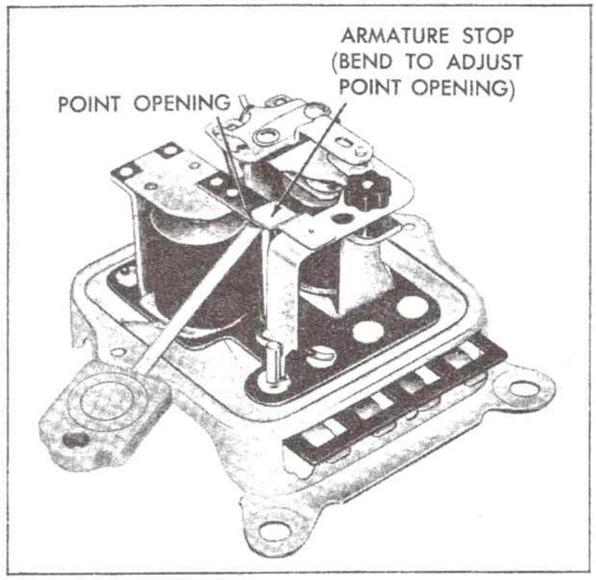


Fig. 6-47 Checking Field Relay Point Opening

b. Voltage Regulator—Air Gap

1. With lower set of contact points just touching, insert a .060 inch feeler gage between armature and coil core, and adjust by turning nylon nut located on contact support, Fig. 6-45.

c. Field Relay—Point Opening

1. With relay contact support spring resting against armature stop, insert a .030 inch feeler gage between contact points, and adjust by bending armature stop, Fig. 6-47.

CHARGING SYSTEM (COMMERCIAL CHASSIS WITH OPTIONAL GENERATOR ONLY)

53. Charging Circuit Precautions

When performing any tests or adjustments on the charging circuit there are certain precautions that must be observed or serious damage will result to the electrical equipment.

1. Do not attempt to "polarize" the generator.

2. Do not short across or ground any of the terminals on generator or regulator.

3. Never operate generator on open circuit. Make certain all connections are secure.

4. Make certain ground polarity of battery and ground polarity of generator are the same when installing a battery.

5. When connecting a booster battery, make certain to connect the negative battery terminals together and positive terminals together.

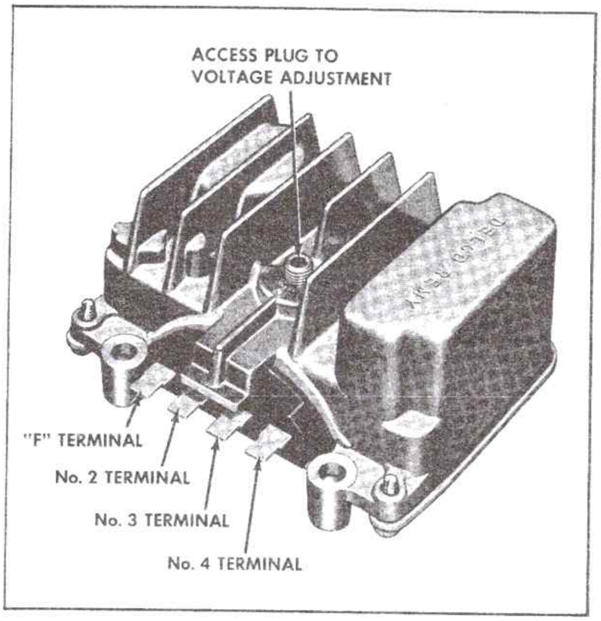


Fig. 6-48 Transistor Regulator

6. When connecting a charger to battery, connect charger positive lead to battery positive terminal and charger negative lead to battery negative terminal.

7. When recharging battery in the vehicle, be sure ignition is turned off when battery terminal connections are made. This will prevent arcing at the terminals which could cause an explosion at the battery.

8. Remove battery cap cover and make sure caps are tight before connecting battery cables.

9. Make sure all electrical accessories are turned off when making battery connections.

54. Preliminary Charging Circuit Checks

Visually check the charging circuit for the following:

1. Frayed insulation or wiring.
2. Tightness of mounting bolts.

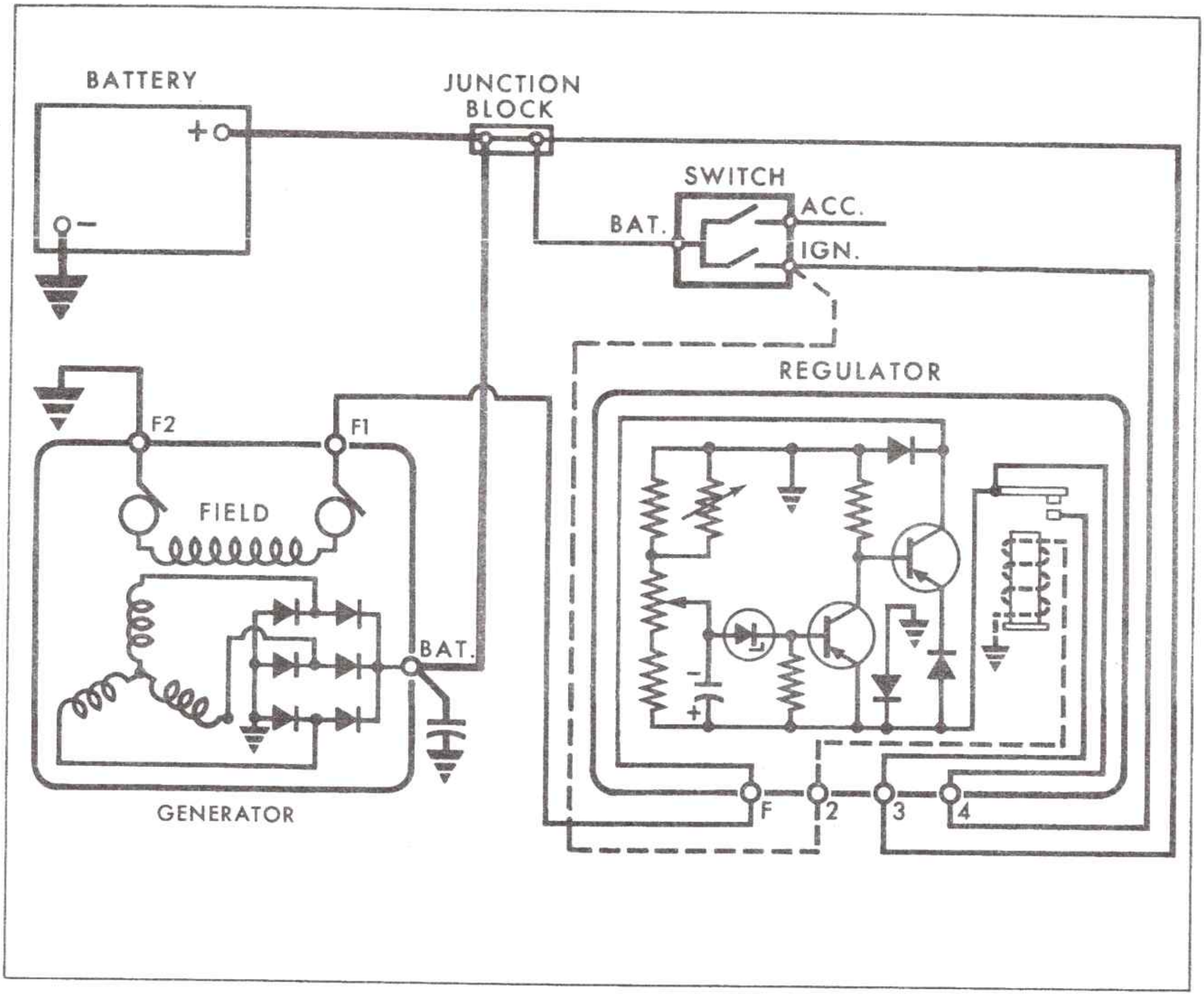


Fig. 6-49 Basic Charging Circuit

3. Corroded or loose connections at generator terminals and slip-on connectors at regulator terminals.

55. Analyzing Charging System Troubles

The checking procedures outlined in Note 56 assume that some malfunction has occurred in the charging system and that it is necessary to determine what is causing the malfunction. Since the charging system consists of four basic units--the regulator, the generator, the wiring and the battery--it is important to determine which unit is causing the trouble in order that the proper unit may be repaired or replaced.

The transistor regulator has an adjustment provision which may be used to tailor the voltage limit for unusual operating conditions that result in overcharged or undercharged batteries. An adjustment of the regulator may be sufficient to correct the under or overcharged battery condition. In the event that the regulator is found to be faulty, it should be replaced.

If the generator is the cause of the malfunction, it may either be replaced or repaired as described in Notes 60, 61 and 62.

Any wiring deficiencies must be repaired or the faulty wiring should be replaced.

The battery should be checked to determine its condition in accordance with Notes 9, 11 and 12 and replacement may be indicated.

The troubleshooting procedures for the regulator are described in Note 58.

56. Testing Ammeter Circuit

a. The Ammeter Indicates A Discharge With All Accessories "Off" and the Ignition Switch In the "Off" Position.

1. There is the possibility that a stuck relay could cause this condition which would lead to a discharged battery. To check this possibility, remove the connector body from the regulator terminals:

a. If the ammeter continues to show a discharge, the problem is elsewhere on the vehicle and an unwanted ground exists.

b. If the ammeter no longer shows a discharge, either a stuck relay exists or there is an unwanted short in the wiring. To check wiring, connect a voltmeter between the regulator No. 2 terminal of the connector body and ground. (Ignition switch must be "off" and connector body is still removed from regulator.) A voltage indication on the meter indicates a short between the wire leading to the No. 2 terminal and a wire containing battery voltage (the wire leading to the regulator No. 3 terminal could be suspected). No voltage indication on the meter indicates a stuck relay and the regulator should be replaced.

b. The Ammeter Indicates A Discharge With All Accessories "Off" and the Engine In Operation At Idle Speed.

1. There is the possibility that an open relay or an open regulator field circuit exists. To check this, first connect a jumper between the regulator base and a good ground. If the ammeter now shows a slight charge, the regulator does not have a good ground. If the grounding of the base makes no difference on the ammeter indication, proceed with step 2.

2. Connect a voltmeter between the regulator No. 2 terminal and ground. No reading on the meter indicates an open between the regulator No. 2 terminal and the battery. Wiring and switch should be checked to locate the open circuit. If battery voltage is noted at the No. 2 terminal, proceed to step 3.

3. Now connect voltmeter between the regulator "F" terminal and ground. If no reading is noted, the regulator should be replaced. If 10 volts or more are available, place voltmeter between the generator "F" terminal and ground. If no reading is noted, the lead from the generator "F" terminal to the regulator "F" terminal is open and should be replaced. If the reading is approximately 10 volts, or more, proceed to Note 57.

c. If Ammeter Operation Seems Proper, But An Over or Undercharged Battery Exists, Proceed To Note 57.

57. Generator Output Test

To check for an undercharged battery condition, as evidenced by slow cranking, follow the procedure beginning with Step 1. For an overcharged battery, as evidenced by excessive battery water usage, begin with Step 9.

1. Connect an ammeter in the circuit at the generator "BAT" terminal, Fig. 6-55.

2. Connect a voltmeter from "BAT" terminal of generator to ground, Fig. 6-55.

3. Disconnect normal lead to "F2" terminal and connect a jumper wire between "F2" terminal and ground, Fig. 6-55.

4. Disconnect normal lead to "F1" terminal and connect a jumper lead from the generator "F1" terminal to the generator "BAT" terminal.

5. Start engine, turn on high beam headlights, and place Automatic Climate Control selector lever in second AUTOMATIC position and insert 1/4 ohm resistor.

6. Slowly increase engine speed to 2,500 RPM and note ammeter reading.

NOTE: As engine speed is increased, vary load control so that voltage does NOT exceed 16 volts.

7. If output is within 15 amperes of rated output, generator is in satisfactory condition.

NOTE: Checking generator output in this manner may allow generator to show 5 - 10% more amperage than shown in specifications. Be sure test ammeter has at least 150 amps capacity.

a. If current output is lower than that specified, repair the generator as described in Notes 60 and 61.

1. If generator failure was caused by a defective stator or diodes, the repaired generator may be replaced on the car and no further checks are needed on the system.

2. If the generator failure was caused by a defective field winding, the repaired generator may be replaced on the car, and the following

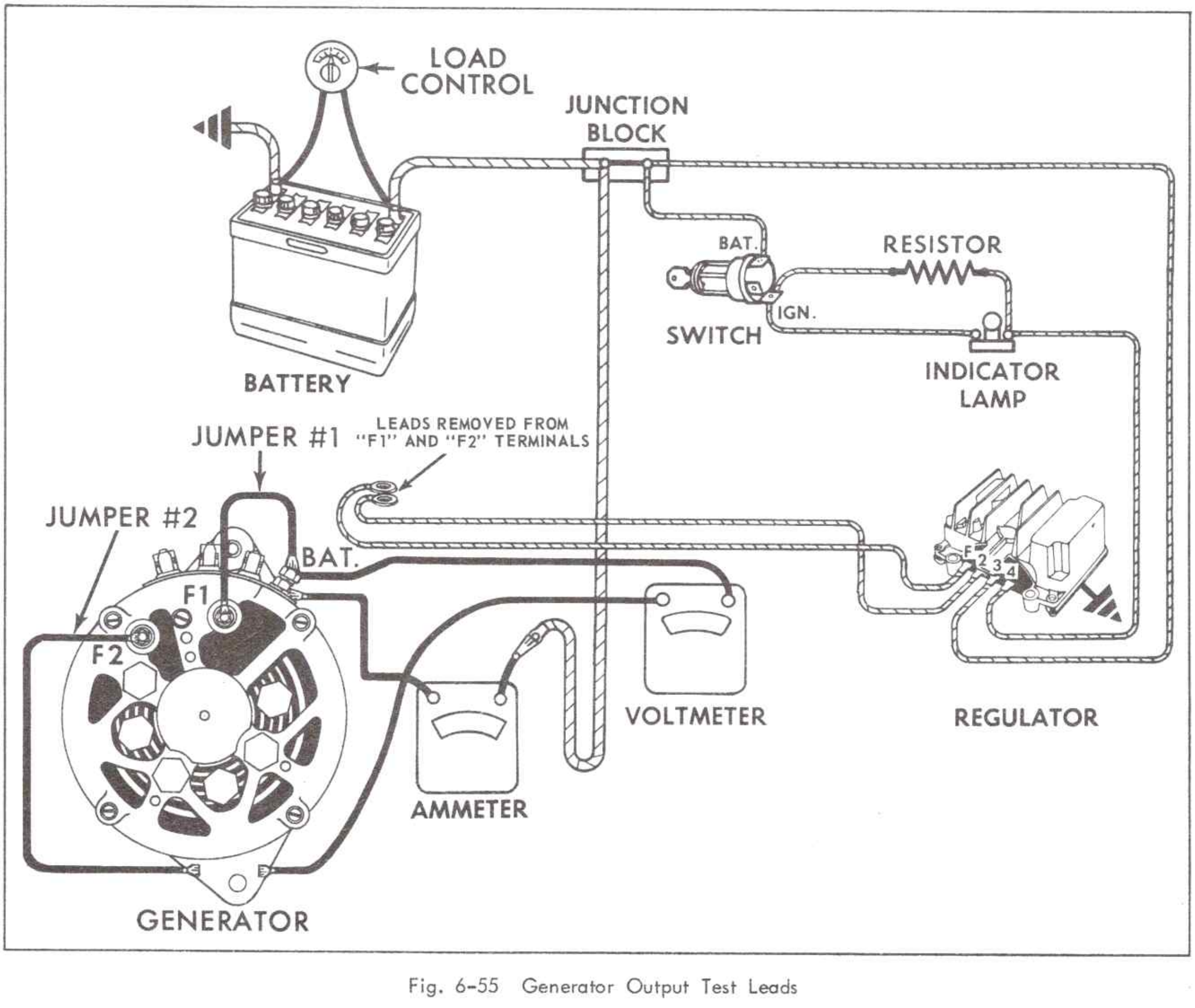


Fig. 6-55 Generator Output Test Leads

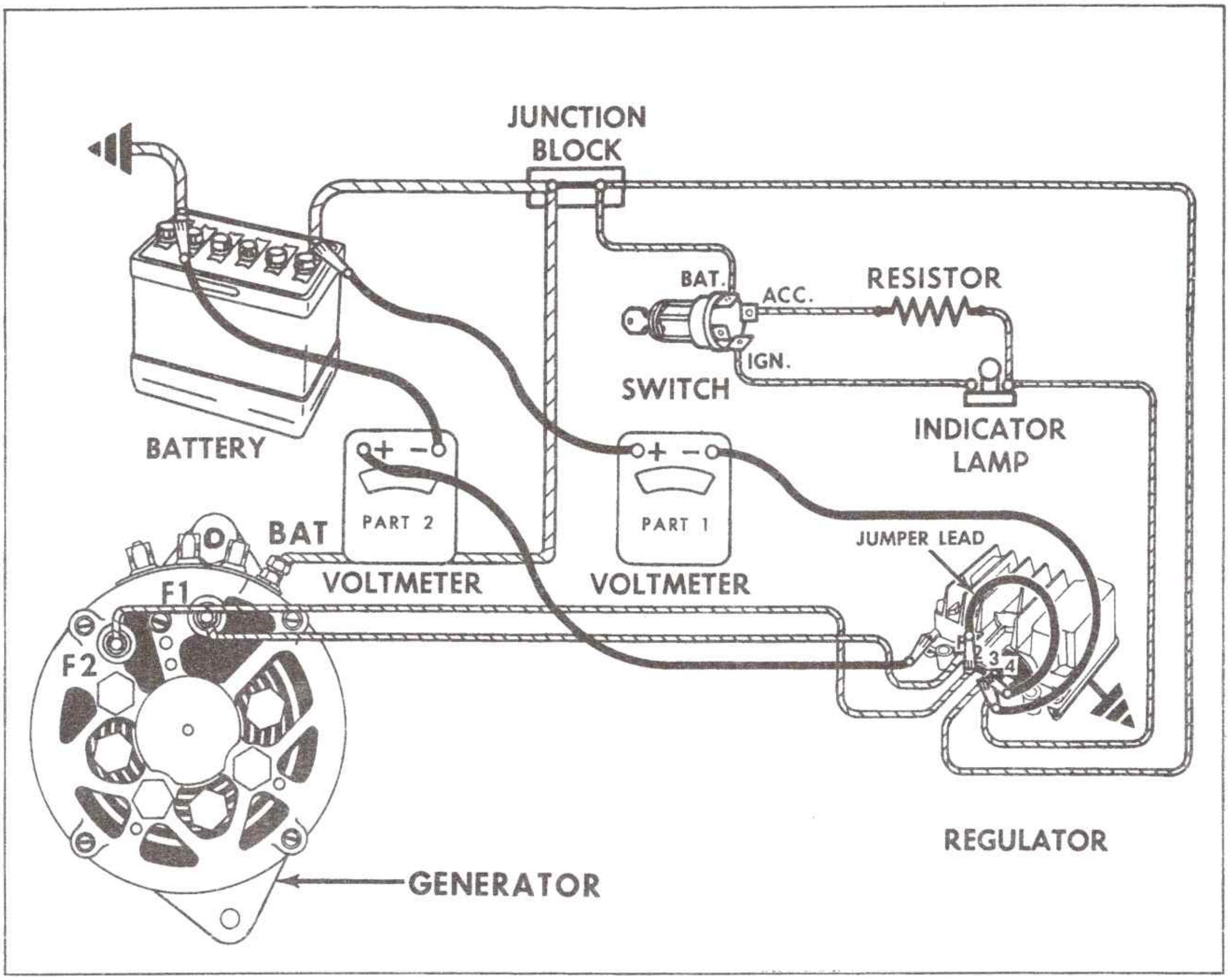


Fig. 6-56 Testing Wiring For Hi Resistance

checks, beginning with Step 8 must be made to locate possible damage to the regulator.

b. If the current output meets the specifications, the generator is okay -- proceed with Step 8.

8. Remove jumper leads, ammeter, and voltmeter from generator and proceed with Step 9.

9. Connect a jumper between the No. 3 and No. 2 terminals, Fig. 6-56. Slide prods into the connector body to make connections. Do not leave jumper lead in this position longer than 5 minutes.

10. Connect voltmeter positive lead to battery positive post and voltmeter negative lead to regulator No. 3 terminal. Turn the ignition switch "on", Fig. 6-56. Read the voltage drop.

11. Connect voltmeter positive lead to regulator mounting bolt, and voltmeter negative lead to battery negative post with jumper lead in position. See Part 2, Fig. 6-56. Record the voltage drop.

Add the voltage from Step #10 voltage from Step #11 to get the Total Voltage Drop.

a. If total voltage drop is greater than .25 volt, check involved system wiring and ground circuits for high resistance. Check regulator for proper ground.

b. If total voltage is less than .25 volt, remove jumper lead between No. 2 and No. 3 terminals, if present, and proceed as follows:

12. Operate the engine at approximately 1500 rpm for 15 minutes with Lower beam headlights "on." Tool J-8529 should be placed on the regulator cover. With engine running, record voltage reading with voltmeter connected from the regulator No. 3 or No. 4 terminal to ground. (Either terminal is satisfactory for this check provided a lead is connected to it.) See Fig. 6-57.

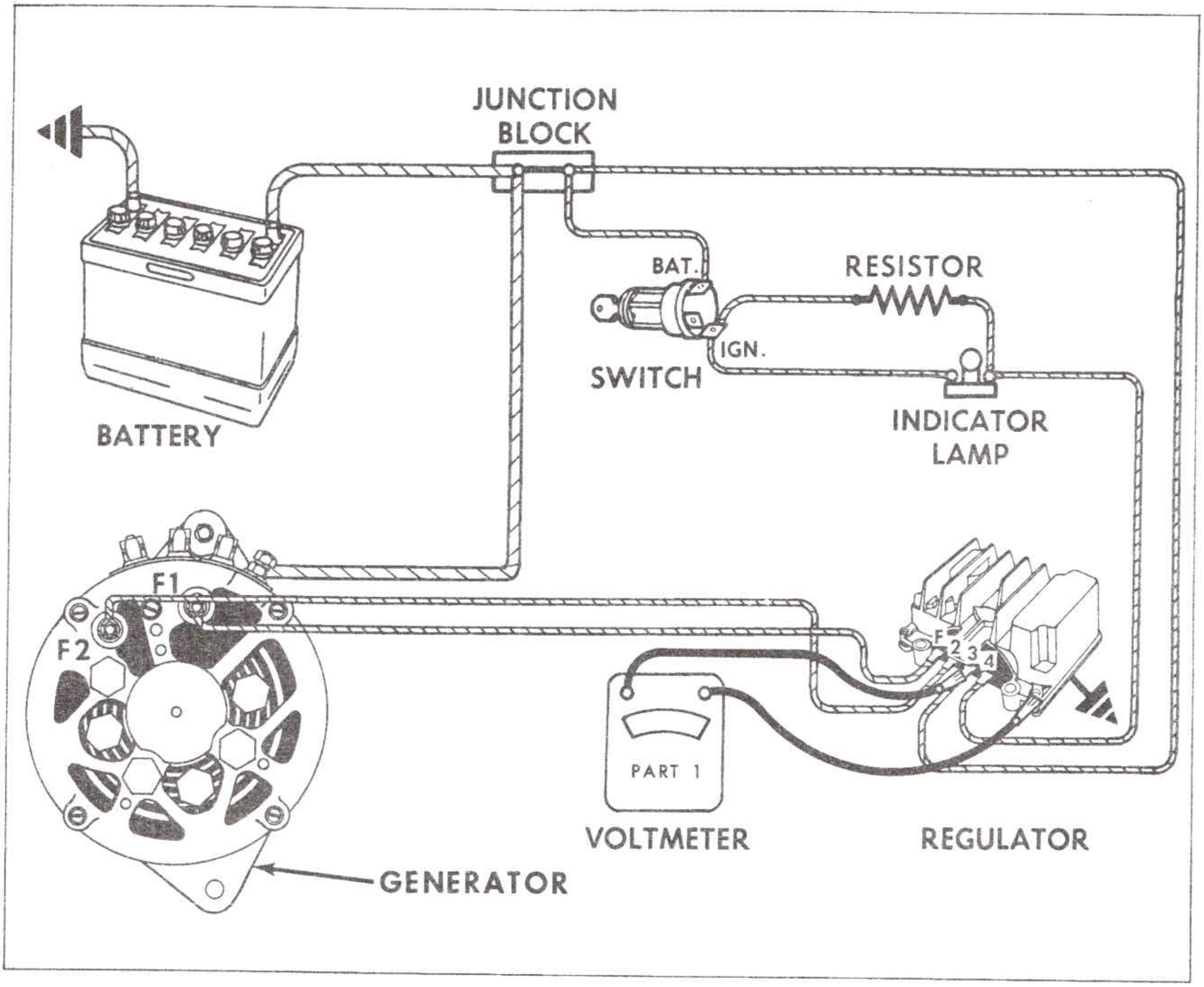


Fig. 6-57 Testing Voltage Regulator Adjustment

Read voltage setting and compare with specifications below. Ambient temperature is measured on tool J-8529.

VOLTAGE TABLE

Ambient Temperature	65°	85°	105°	125°	145°	165°	185°
Normal Voltage Setting	14.1 to 14.9	13.9 to 14.7	13.7 to 14.5	13.6 to 14.3	13.4 to 14.2	13.2 to 14.0	13.1 to 13.8

NOTE: If actual voltage is not within the specified range, remove access plug from regulator cover and note the position of the plastic screw slot beneath the plug. The slot will be lined up with one of the divisions or lines cast on the regulator cover. For each division the slot has been moved clockwise from the middle position ("O" position) or toward the "+" cast on the cover, add 0.3 volt to the above specified range for the proper specified voltage limits. For each division the slot has been moved counterclockwise from the middle ("O" position) or toward the "-" on the cover, subtract 0.3 volt from the above specified range for the proper specified voltage limits. As an example, assume that the slot is lined up with the second line from the "O" nearest the "+" mark. This position would require adding of 0.6 volt to the specification voltage shown in the specification table. The limits at 125° would become 13.5 to 15.5 volts instead of the 12.9 to 14.9 volts specified for the middle or "O" position.

If the actual regulating voltage as checked is

not within the voltage range specified for the measured ambient temperature, the regulator should be replaced.

13. If the actual regulating voltage as checked in Step 12 is within the voltage range specified for the measured ambient temperature, the charging system operation is satisfactory. However, the voltage setting of the regulator needs to be changed to a different value to meet the battery charging requirements of the type of driving being done. To adjust the voltage setting properly, refer to Note 59.

58. Checking Voltage Setting

The desired voltage regulator setting is one which keeps the battery in a satisfactory state of charge (3/4 charge or more) without causing excessive battery overcharge (as evidenced by excessive battery water usage).

The "normal" setting (values shown in the "Voltage Table" above) usually will be satisfactory for the vehicle operated in average type service conditions. However, if operating service conditions are above or below average, the voltage regulator setting must be adjusted or tailored to adapt it to the battery and type of service conditions.

Either of two conditions may persistently exist which indicate the need for adjusting the regulator setting: (1) battery is being overcharged, (2) battery remains undercharged. Corrections should be made as follows:

1. If the battery uses too much water at the "normal" setting, reduce the voltage setting approximately 0.3 volt and check for decreased battery water usage over a reasonable period. If necessary, repeat this process until the battery remains charged with a minimum use of water.

2. If the battery is consistently undercharged (evidenced by inability to crank the engine) at the "normal" setting, increase the voltage setting 0.3 volt and check for improved condition over a reasonable service period. If necessary, repeat this process until the battery remains charged with a minimum use of water.

59. Adjusting Voltage Regulator Setting (Fig. 6-58)

To adjust the voltage setting of the transistorized regulator, remove the access plug from the regulator. Then for an undercharged battery insert screwdriver into slot and turn clockwise one notch (0.3 volt) to increase the setting. For an overcharged battery, turn counterclockwise one notch (0.3 volt) to decrease setting. See Fig. 6-58. Then check for an improved battery condition over a service period of reasonable length. If necessary, repeat the above procedure for a higher or lower setting.

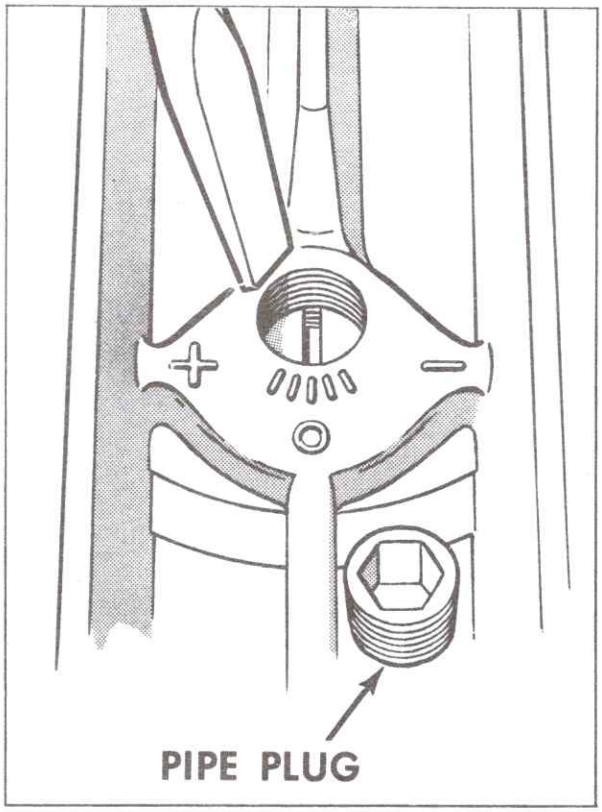


Fig. 6-58 Adjusting Voltage Regulator Setting

60. Generator—Removal and Disassembly (Commercial Chassis with Optional Generator Only)

a. Removal (Fig. 6-59)

1. Disconnect battery ground cable at battery.

2. Disconnect wires from "BAT", "GRD", "FI" and "F2" terminals at the generator. Also disconnect any leads from the "AC" terminals.

3. Remove generator link adjusting screw.

4. Remove two nuts and lock washers from mounting bolts at front and rear of generator mounting bracket.

5. Disconnect drcvdnbelt from generator pulley.

6. Remove two bolts securing generator to mounting bracket.

7. Remove generator from vehicle, leaving mounting bracket in car.

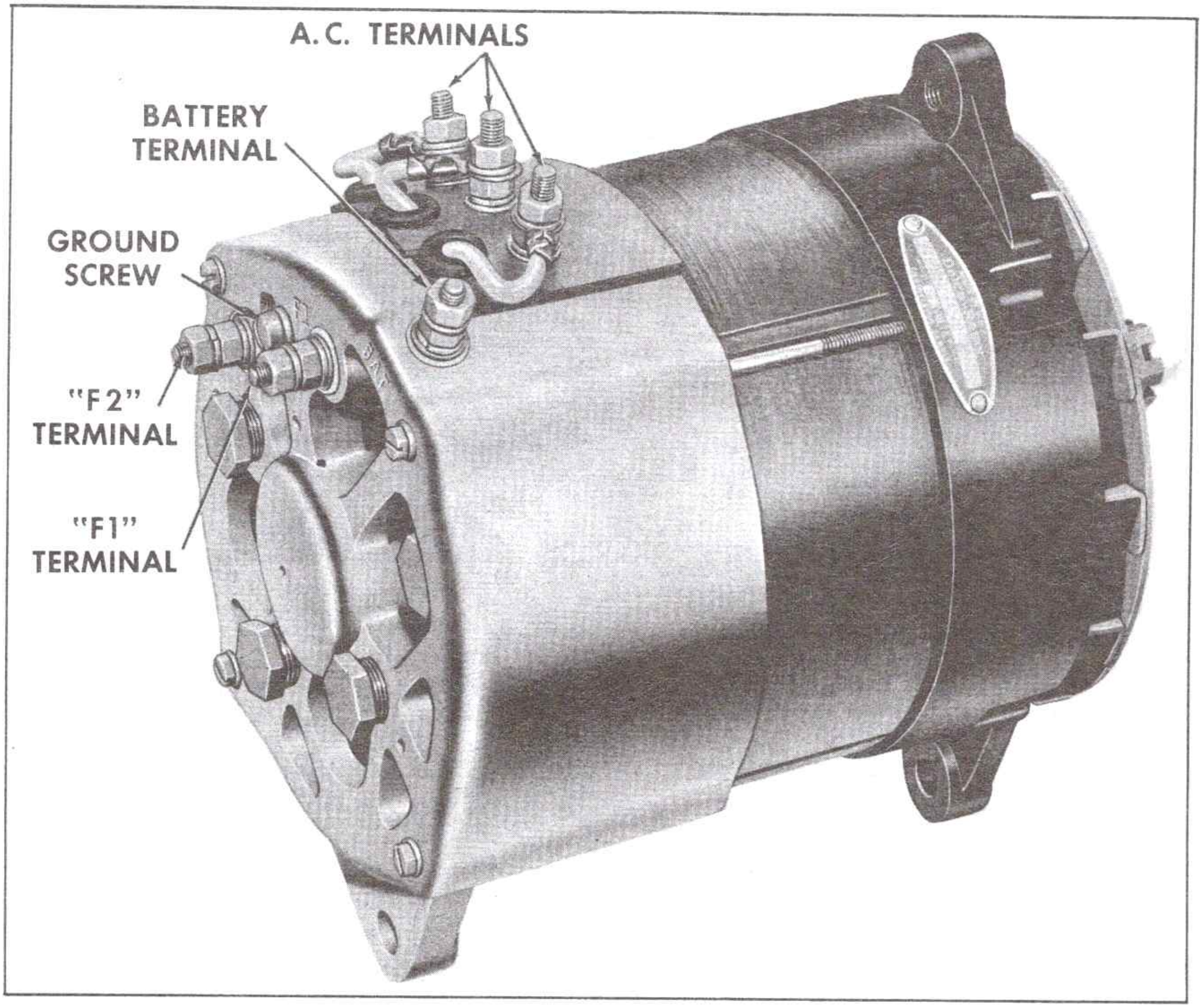


Fig. 6-59 A. C. Generator

b. Disassembly (Fig. 6-60)

1. Remove four through bolts securing drive end frame to slip ring end frame, Fig. 6-60.

2. Separate drive end frame, with rotor, from slip ring end frame by tapping lightly on mounting lugs with a plastic mallet.

CAUTION: To prevent damage to the brushes during this operation, insert a through bolt into the slip ring end frame and lift the brushes off the slip rings.

NOTE: Brushes should be cleaned as soon as possible to prevent grease from soaking into brushes.

3. Remove stator assembly from heat sink end frame by removing the three AC leads from the AC terminals and tapping the heat sink away from the stator.

4. To remove brushes proceed as follows:

a. Remove retaining clip from brush holder pivot and remove both brushes and brush springs.

b. Remove two nuts with lock washers and flat washers from "F1" and "F2" terminals.

c. Remove studs from heat sink end frame and remove brush assemblies.

5. Cover slip ring roller bearing on rotor shaft with a rag and tape securely to prevent collecting dirt or other foreign material.

6. Block pulley-fan assembly and remove pulley retainer nut, washer, pulley-fan assembly, woodruff key and spacer from rotor shaft.

7. Remove rotor assembly by removing four screws holding bearing retainer plate to drive end frame and separate drive end frame from rotor assembly.

8. The heat sink should not be removed unless inspection indicates need for replacement. Refer to Note 61B.

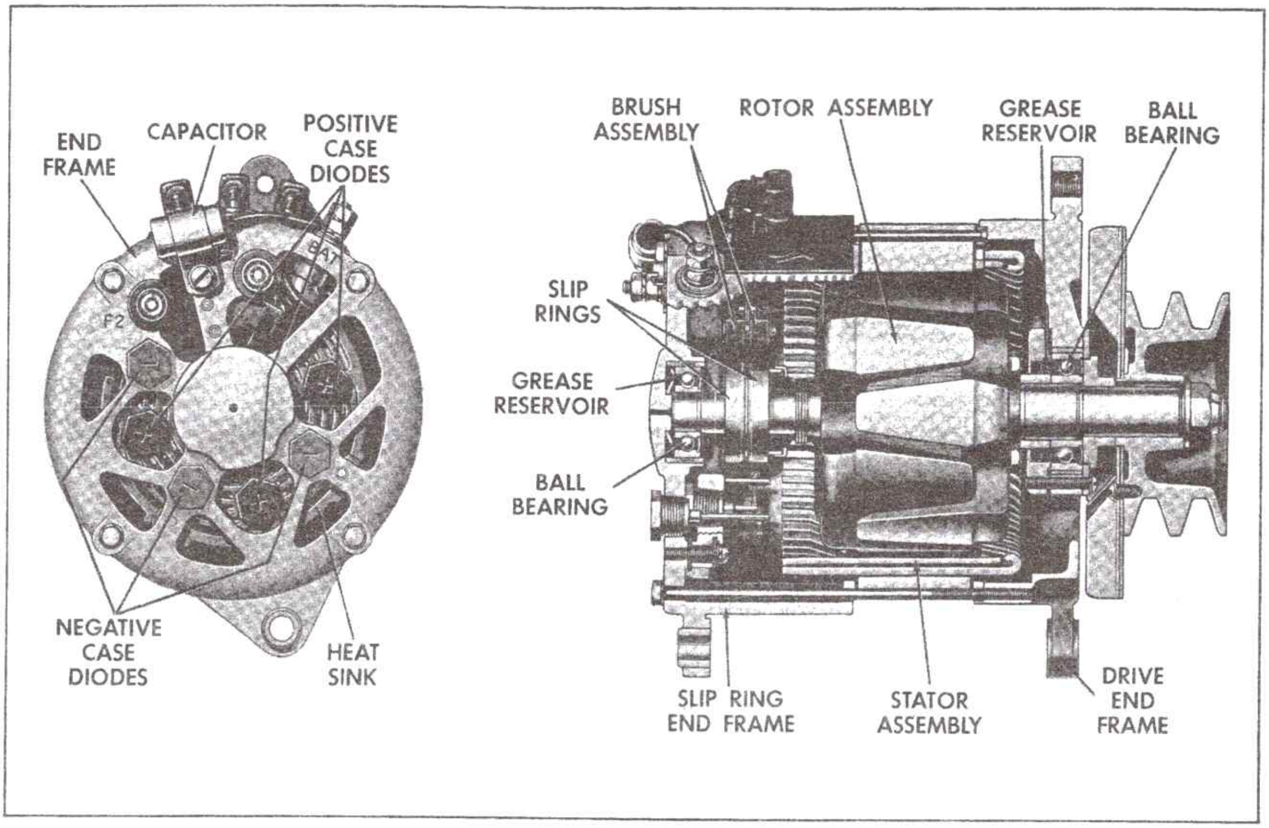


Fig. 6-60 Generator Cut-Away View

61. Generator Components, Inspection, Testing and Replacement (Commercial Chassis with Optional Generator Only)

a. Brush Holder Assembly

1. Inspect brush springs for any evidence of damage or corrosion.

2. Inspect brushes for excessive wear and brush pigtails for signs of fraying, Fig. 6-65.

3. Inspect brush holders for signs of cracks.

NOTE: The brush holder assembly, including brushes, is serviced as an assembly.

b. Heat Sink

1. Inspect heat sink for signs of cracks.

2. If necessary, replace heat sink by removing two terminal bolts and capacitor lead retaining screw. Carefully note arrangement of parts so that BAT and GRD terminals are replaced in the same order.

To remove heat sink proceed as follows:

a. Perform steps 1 through 4 of generator disassembly, Note 59b.

b. Loosen "BAT" terminal lock nut so that "BAT" terminal stud moves freely.

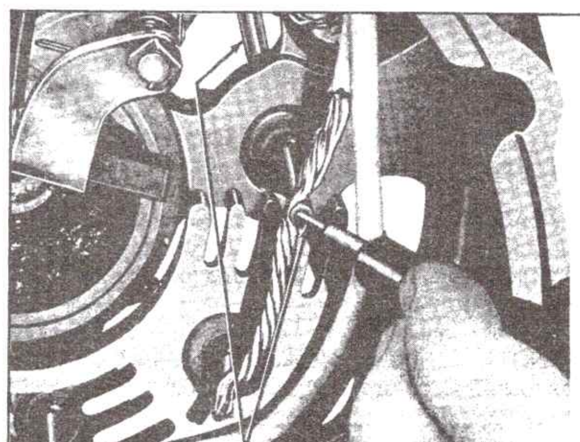
c. Remove two screws with lock washers and flat washers holding heat sink to end frame.

d. Cut diode leads in three places as shown in Fig. 6-62, and remove heat sink from end frame.

c. Diodes

1. Make sure that stator is disconnected and that each diode lead is disconnected.

2. Connect Test Light, J-21008, leads across each diode, first in one direction and then in the other, Fig. 6-61.



OHMMETER PRODS (TOUCH TO DIODE CASE AND DIODE LEAD)

Fig. 6-61 Diode Checking

NOTE: When performing these tests, use only Test Light, J-21008 or an ohmmeter.

Diodes may also be checked for defects with an ohmmeter as shown in Fig. 6-61. To check each diode, connect one of the ohmmeter leads to the diode case, and the other ohmmeter lead to the diode lead, and note the ohmmeter reading. Then reverse the ohmmeter lead connections and note the reading. Ohmmeter readings may vary considerably when checking diodes, but if both readings are 300 ohms or less, the diode is defective. Also, if both readings are greater than 300 ohms, the diode is defective. A good diode will give one low and one high reading. When checking each diode, push and pull on the diode lead to catch loose connections, and use an ohmmeter with a scale on which the 300 ohm value can be accurately read.

3. If lamp lights in both directions, or fails to light in either direction, diode is defective. When checking a good diode, lamp will light in only one direction.

4. If it is necessary to replace a diode mounted in the outside frame, use diagonal cutters to clip the flexible leads on each side of the diode lead. Clip the flexible leads as close to the diode lead as possible, Fig. 6-62.

5. To permit easy removal of the defective diode, it is recommended that the diode and outside frame be heated in an oven to 150°F. or briefly submerged in hot water just below the boiling point.

6. Before installing the new diode, lightly coat the threads with silicone grease or light engine oil. With the diode and outside frame at room temperature, install the diode and torque to 160-190 inch-pounds.

7. Place the single diode lead clip furnished with the replacement diode over the diode lead,

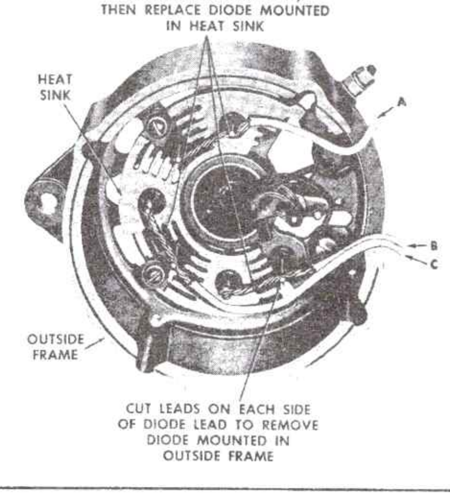


Fig. 6-62 Replacing Defective Diodes

and place the ends of the flexible leads into the clip. Crimp the clip tightly over the flexible leads, and liberally solder the leads to the clip, and the clip to the diode lead.

CAUTION: Use only 60% tin, 40% lead solder, or other solder with melting point of 360°F. or above. Do not hold the soldering iron on the leads any longer than necessary, as excessive heat may damage the diode.

8. If it is necessary to replace a diode mounted in the heat sink, it will be necessary to remove the heat sink from the end frame. This is accomplished by clipping with diagonal cutters the flexible lead as close to the defective diode lead as possible. Also clip the flexible leads midway between the other two pairs of diodes, Fig. 6-62. Then remove the "BAT" terminal and heat sink attaching screws, and the long leads from the nylon connector. For easy removal of the defective diode, it is recommended that the diode and heat sink be heated in an oven to 150°F., or briefly submerged in hot water just below the boiling point.

9. Before installing the new diode, lightly coat the threads of the new diode with silicone grease or light engine oil. With the diode and heat sink at room temperature, install the diode and torque to 160-190 inch-pounds. Attach the heat sink to the frame, place the single diode lead clip furnished with the replacement diode onto the diode lead, insert the flexible lead into the clip, crimp securely, and solder the lead to the clip and the clip to the diode lead. Also, use the two connectors to reconnect the flexible leads together. Place the leads into the connectors, crimp securely, and solder.

CAUTION: Use only 60% tin, 40% lead solder, or other solder with melting point of 360°F., or above. Do not hold the soldering iron on the leads any longer than necessary, as excessive heat may damage the diode.

NOTE: Replacement diodes have a long diode lead. If the diode is to be assembled into the heat sink, it is necessary to cut off the diode lead to an over-all length of 1-3/8 inches, Fig. 6-63. To cut off the diode lead, hold the diode lead with ordinary pliers or vise grip pliers, and use large diagonal cutters or a hack saw, Fig. 6-64.

CAUTION: Do not grip the diode case when cutting the lead, as this will place stress between the diode case and the diode lead, and will damage the diode internally.

d. Stator

1. Make sure stator leads are disconnected.

2. Check stator windings for grounds or opens, using a 110-Volt Test Lamp, Fig. 6-41.

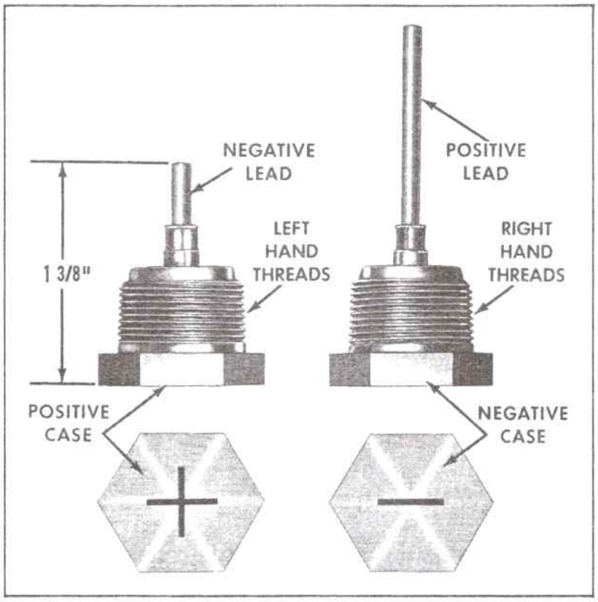


Fig. 6-63 Diode Polarity

GROUNDS - If test lamp lights when connected from any lead to stator frame, windings are grounded.

OPENS - If lamp fails to light when successively connected between each pair of stator leads, windings are open.

SHORTS - A short circuit in the stator windings is difficult to find due to the low resistance in the windings. However, if all other electrical checks are normal and generator still fails to supply rated output, it is an indication that the stator windings are probably shorted.

3. If necessary to replace stator, it must be replaced as a unit.

e. Rotor

1. Test rotor for grounds or opens with the aid of 110-Volt Test Lamp, Fig. 6-42.

GROUNDS - Connect test lamp from either slip ring to rotor shaft or rotor poles. If lamp lights, field winding is grounded.

OPENS - Connect the leads of the test lamp to each slip ring. If lamp fails to light, winding is open.

SHORTS - Connect a 12-volt battery and ammeter in series with slip rings and note ammeter reading. If above 2.6 amperes, it is an indication that a shorted winding exists.

2. If rotor is defective, replace as a unit.

3. Inspect slip rings. If they are dirty, they may be cleaned and finished with 400 grain, or finer, polishing cloth. Spin rotor in a lathe to insure that slip rings are cleaned evenly with no flat spots.

4. If necessary, slip rings that are out of round or rough should be turned in a lathe to .002 inch maximum indicator reading. Finish with a 400 grain or finer polishing cloth.

5. Slip rings which must be replaced can be removed from the shaft with a gear puller after the leads have been unsoldered. The new assembly should be pressed on with a sleeve which just fits over the shaft; this will apply all the pressure to the inner slip ring collar and prevent damage to the outer slip rings. Only pure tin solder should be used when reconnecting the field leads. Make sure the soldered connections are secure. New slip rings must be turned in a lathe to a smooth finish with .002 inch maximum indicator reading. Finish with 400 grain or finer polishing cloth.

f. Brush Replacement

The brushes may be allowed to wear until part of the holder itself is actually worn away as shown in Fig. 6-65. This will not damage the slip rings or affect performance. The brushes should not be allowed to wear beyond the 1/4 inch dimension shown in Fig. 6-65. Replacement is accomplished by installing a new holder, brush, lead, and terminal assembly. Note that there are both righ and left hand holders and springs. Both brush holders should be to the right of their pivot pin as viewed from the outside of the rectifier end frame.

g. Capacitor

To replace capacitor, remove nut securing capacitor lead to "BAT" terminal and remove

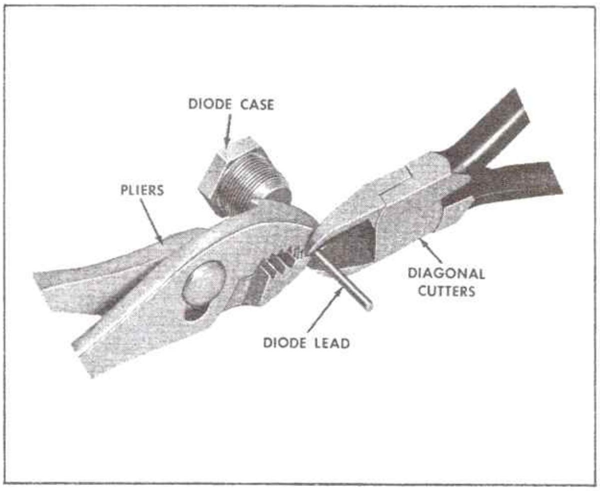


Fig. 6-64 Cutting Diode Lead

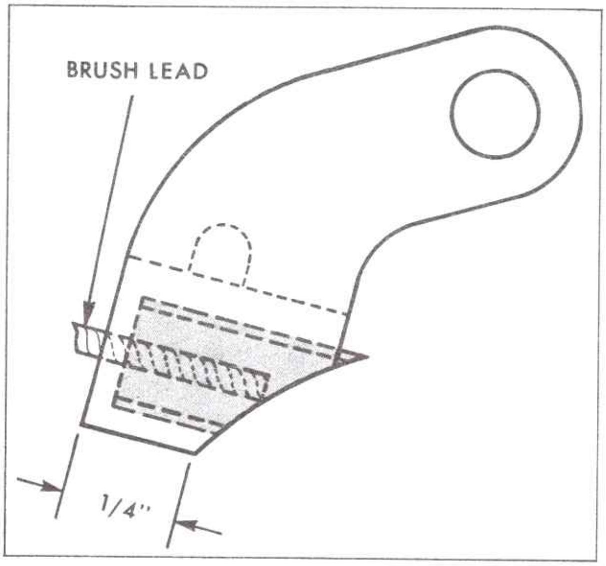


Fig. 6-65 Maximum Brush Wear

lead from terminal. Loosen retaining screw from heat sink end frame and remove capacitor from holder.

h. Ball Bearing—Drive End Frame

NOTE: Do not remove bearing unless it is going to be replaced.

To remove bearing, secure rotor in a vise using brass jaws to prevent damage to the rotor. Remove bearing from shaft using puller J-1859-02, Fig. 6-66.

To install bearing, drive new bearing onto shaft using a 15/16" deep well socket against the inner

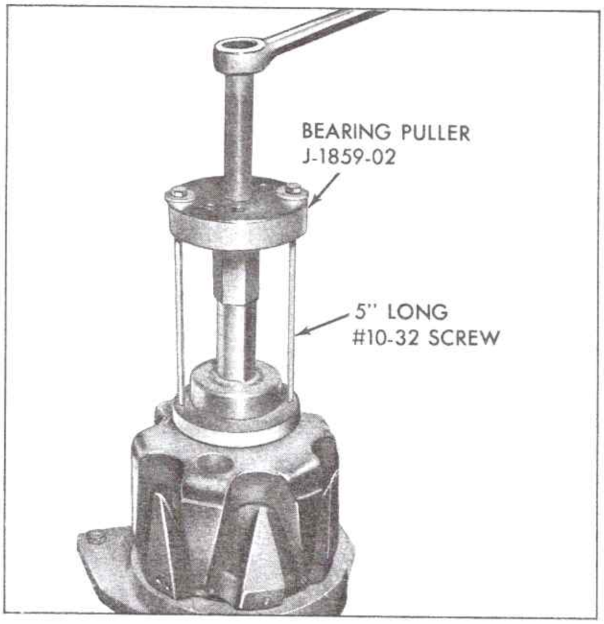


Fig. 6-66 Removing Drive End Bearing

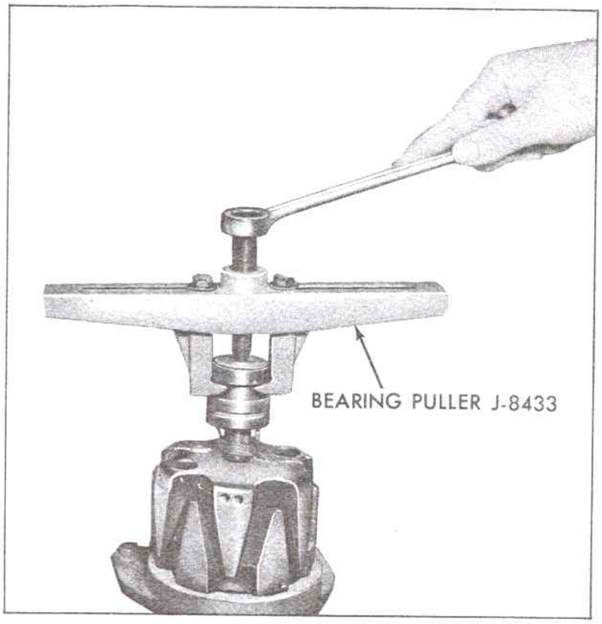


Fig. 6-67 Removing Heat Sink End Bearing

race. Drive until bearing butts against shoulder on rotor shaft.

i. Ball Bearing—Heat Sink End Frame

NOTE: Do not remove beaaing unless it is going to be replaced.

To remove bearing, secure rotor in a vise using brass jaws to prevent damage to the rotor. Install tool J-8433-1 on heat sink end frame bearing and remove bearing from shaft, Fig. 6-67.

To install bearing, drive new bearing onto shaft using a 5/8" deep well socket against the inner bearing race. Drive until bearing butts against shoulder on rotor shaft.

j. Lubrication

Under normal operating conditions, the generator will not require lubrication between overhaul periods. The grease reservoir in each end frame provides an adequate supply of lubricant for long periods of operation.

Before assembly after generator overhaul, each reservoir should be half filled with special lubricant available from your servicing Parts Warehouse.

CAUTION: Make sure that after assembly the reservoirs will be only half filled. Overfilling will cause the bearings to overheat. At overhaul periods, the bearing should be replaced with a new bearing, and the felt seals should be replaced with new ones.

If the bearings are inspected before the overhaul period, they may be re-used if the grease supply in the bearing is not low or has not been exhausted. However, if the grease supply in the bearing is low or exhausted, the bearing should be replaced with a new bearing.

CAUTION: Make sure the sealed side of the slip ring end bearing is on the side away from the grease reservoir and the open side is toward the grease reservoir. Satisfactory bearing life will be obtained only if recommended lubrication procedures are followed.

62. Generator—Assembly and Installation (Commercial Chassis with Optional Generator)

a. Assembly

1. Assemble drive end frame on rotor shaft. Install bearing retainer plate and secure with four screws.

2. Install spacer, woodruff key, pulley-fan assembly, washer and retaining nut on rotor shaft. Torque retaining nut to 60 foot-pounds.

3. Assemble brush assemblies in heat sink as follows:

a. Install brush with lead from "F1" terminal on brush pviot and install lower spring with open end against stop and hooked end against brush assembly.

NOTE: Springs are not identical. The hooked end should be down on the lower spring and up on the upper spring.

b. Install upper spring and install brush with lead from "F2" terminal. Connect spring to brush assembly as described in Step 3a.

c. Secure brush assemblies with retainer clip.

4. Install stator into heat sink end frame assembly and fasten leads to AC terminals as follows:

a. The lead designated "A" in Fig. 6-62 should be connected to the AC terminal on the end closest to the "BAT" terminal.

b. The lead designated "B" in Fig. 6-62 should be connected to the AC terminal at the opposite end.

c. The lead designated "C" in Fig. 6-62 should be connected to the center AC terminal.

5. Install drive end frame on rotor shaft and secure with four screws and retainer plate.

6. Secure rotor in a vise using brass jaws to prevent damage to the rotor and install spacer, woodruff key, pulley-fan assembly, washer and retaining nut on rotor shaft. Block fan and torque retaining nut to 60 foot pounds.

7. Secure drive end frame in a vise with heat sink end of rotor straight up. Lower the heat sink-stator assembly onto the rotor while holding the brushes away from the slip rings with a through-bolt. Secure heat sink end frame to drive end frame with four through-bolts.

b. Installation

1. Position generator on mounting bracket and install two bolts through mounting lugs. Install lock washers and nuts on mounting bolts but do not tighten.

2. Install generator link adjusting screw but do not tighten.

3. Install drive belt(s) on the pulleys and adjust belt tension as described in Note 49b.

4. Tighten two mounting bolts to 18 foot pounds.

5. Connect wires at "BAT", "F1" and "F2" terminals.

6. Connect battery ground cable at battery.

NOTE: It is not necessary to "polarize" this generator and this procedure should not be attempted.

63. Accessory Ground Circuit Test

The headlights and accessories are usually grounded to the body or sheet metal of the car. If there is not a good ground circuit between the car body and the engine, there will be a voltage drop from the car body to the engine when the lights and accessories are turned on. This condition will result in light flare-up.

NOTE: This test must be made with the ignition switch off.

1. Turn voltmeter selector switch to 4 volt position.

2. Connect one voltmeter lead to a ground on car body and the other lead to a ground on engine.

3. Turn on all lights and accessories, then note voltmeter reading. This should not exceed .1 volt.

4. If voltmeter reading exceeds .1 volt, test voltage drop at ground strap connection between engine and car body, and tighten connections or replace strap.

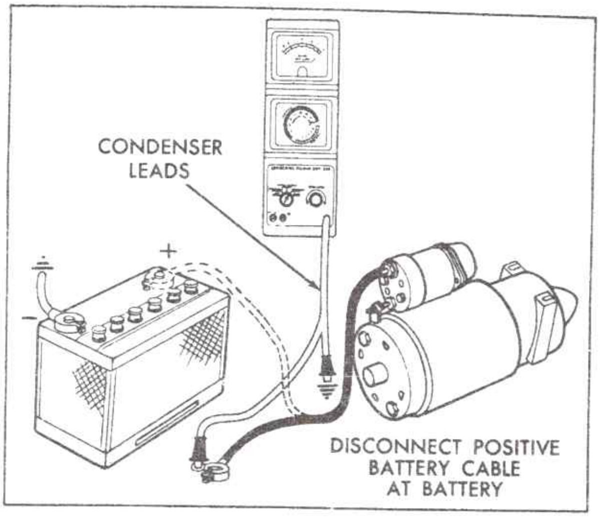


Fig. 6-68 Primary Wiring Test

64. Primary Wiring Insulation Test

This test, using a Megohm Tester, is used to detect intermittent short circuits. The Megohm Test applies approximately 500 volts to the circuit and will show intermittent and "damp weather" shorts that cannot be found by any other methods.

NOTE: If car has been subjected to wet weather the tester will show out of the blue band. Car wiring must be dry.

1. Disconnect positive cable from battery post.

2. Disconnect lead at generator BAT terminal to prevent damaging diodes.

3. Turn off all switches, and close all doors to prevent operation of courtesy light from door switches.

4. Turn tester master switch "On".

5. Connect condenser tester leads together and turn switch to megohm position. Adjust meter to "Set Line" with regulator.

6. Touch positive battery cable to its battery post to wind clock or disconnect clock for safety.

7. Connect condenser leads as shown in Fig. 6-68. Meter should read in blue meg band if insulation in primary circuit is normal.

8. If tester reads out of the blue band after disconnecting the clock, the short in the primary wiring circuit may be located by disconnecting the battery (positive) wire at each of the following units in turn:

Stop Light Switch	Ignition Switch
Courtesy Light Switches	Regulator
Horn Relay and Wire	Generator
Starter Switch	All Accessory Unit Switches
Headlight Switch	

65. Engine Tests

Engine tests include the inspection, testing and adjustments of the various components of the engine and engine accessories. These various tests have been covered in detail in this section, or other sections, and only a reference to the note number will be made here.

1. Inspect and test battery. This includes visual inspection, battery test, or full charge hydrometer test as outlined in Notes 9, 10, 11, and 12.

2. Inspect and test starting system. This includes lubrication, inspection and starter motor circuit resistance test as outlined in Note 19.

3. Inspect and adjust distributor contact points as explained in Note 28.

4. Inspect and clean positive crankcase ventilation filter(s) as described in Note 91.

5. Make certain engine idle rpm is correctly adjusted, Note 88.

6. Inspect and test performance of charging system as outlined in Note 40.

7. Test regulator for proper performance as explained in Notes 51 or 58.

8. Check ignition timing, Note 33.

9. To provide an indication of over-all performance of entire ignition system, make secondary efficiency test, Note 34.

10. The fuel system should be inspected thoroughly. Clean all fuel lines, strainers and flexible lines. The fuel filter strainer must be replaced if plugged.

11. Check and replace carburetor air cleaner, Section 0, Note 3c or 3d.

12. If carburetor is not functioning properly, it should be overhauled, Notes 66 through 90.

13. Test fuel pump for proper volume and pressure, Note 101.

14. Clean and set spark plugs, Note 38.

15. Test ignition primary circuit for excessive voltage drop which would lessen secondary output coil, resulting in hard starting and poor performance, Note 35.

16. Test coil continuity and capacity for proper performance, Note 36d.

17. Test capacitor for series resistance, capacity and insulation, Note 37.

18. Check all water hoses and tighten clamps.

19. Tighten cylinder head screws - 60 foot-pounds.

20. Tighten intake manifold screws to 30 foot-pounds and nuts to 25 foot-pounds.

21. Adjust generator belt tension to proper tension, Note 49 or 50.

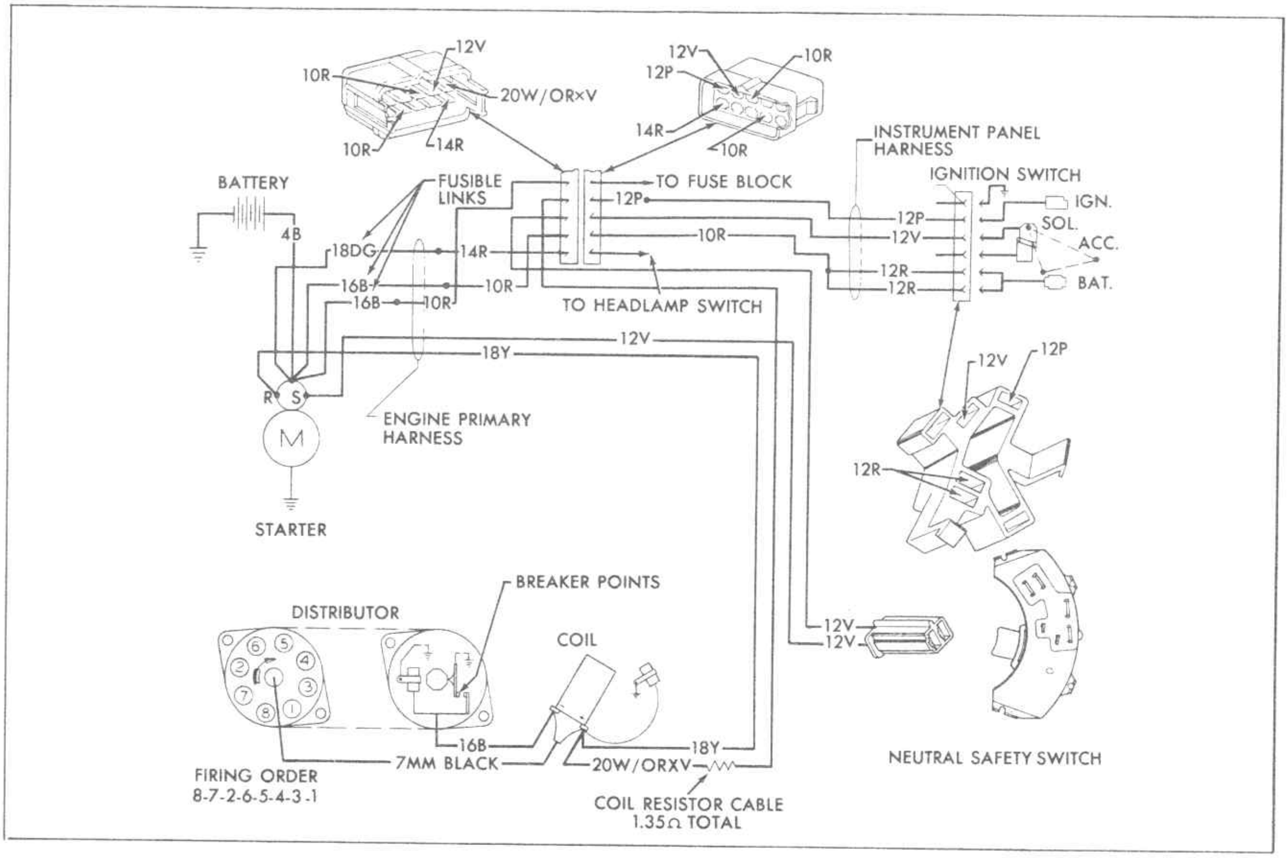


Fig. 6-69 Ignition and Starter Circuits (Except 693)

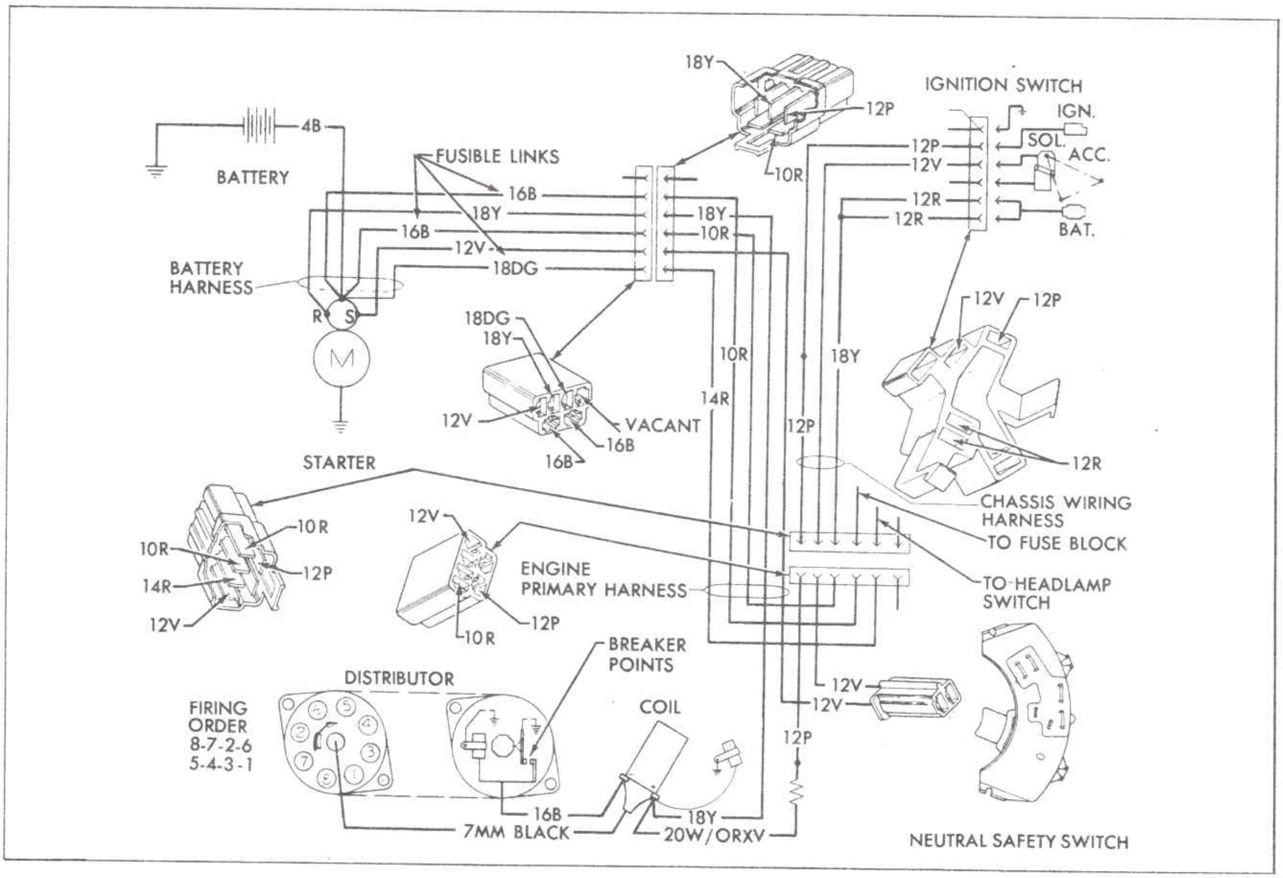


Fig. 6-70 Ignition and Starter Circuits (693)

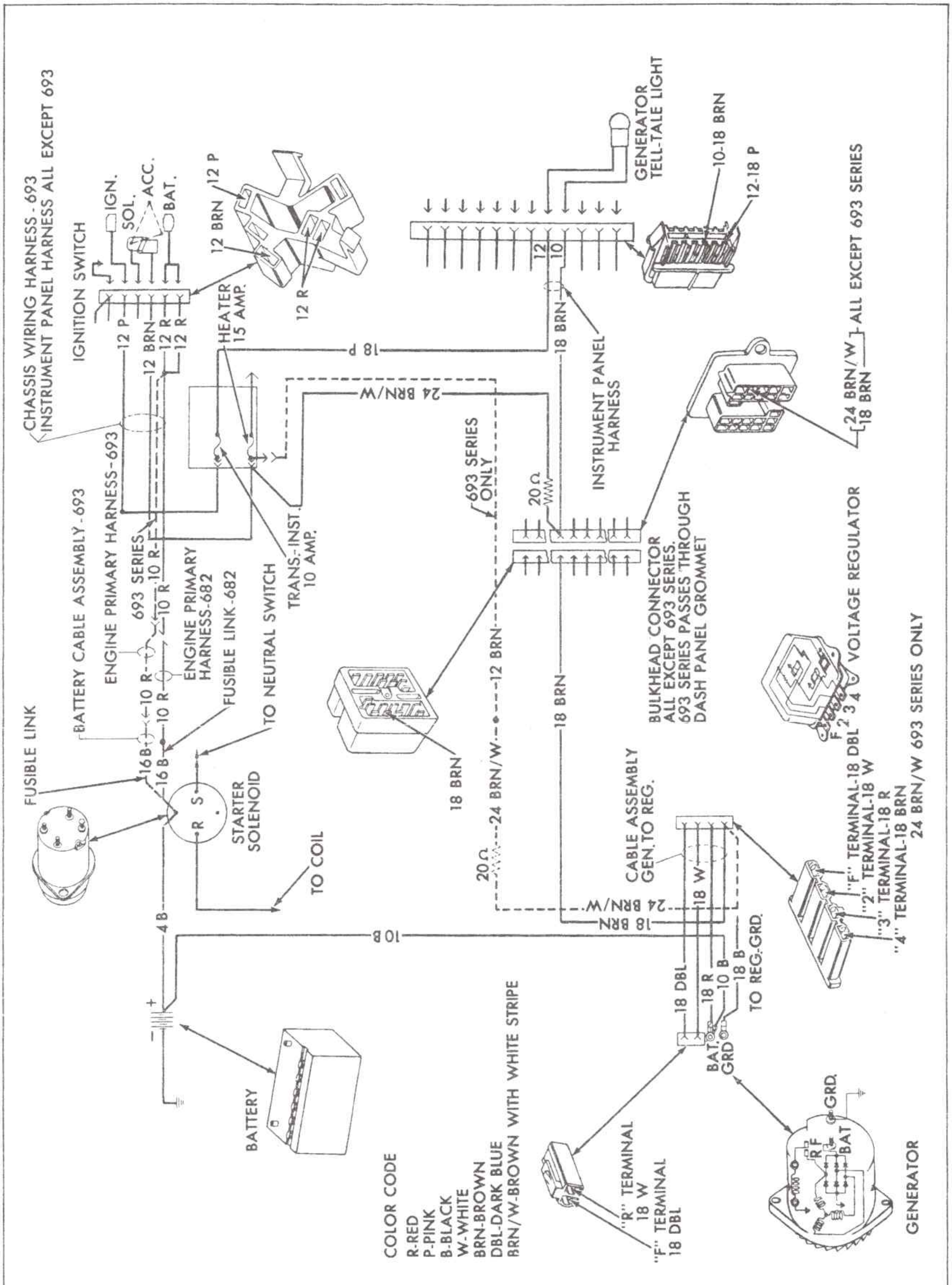


Fig. 6-71 Generator-Regulator Circuit Diagram

BATTERY CHARGING CHART

Condition	Rate	Time
Slow Charge	4 Amps	24 hours
Fast Charge	40-50 Amps	1 1/2 hours
Emergency Boost Charge	40-50 Amps	30 minutes
*Dry Battery Warm-up Charge	15 Amps	10 minutes

*Required for dry charged batteries being activated with electroylyte at a temperature below 60°F or batteries which are to go into immediate operation in below freezing temperatures.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
286M	Distributor Clamp Nut	5/16-24	18
1112	Generator Support Bracket to Exhaust Manifold Nut	3/8-24	18
260M	Generator Adjusting Link to Generator Screw	5/16-18	10
260M	Generator Support Bracket to Exhaust Manifold Screw	3/8-16	18
	Spark Plugs (Type 44)	14 mm	25
260M	Adapter Ring to Starter Motor Screw	3/8-16	23
260M	Starter Motor to Adapter Ring Screw	3/8-16	23
Special	Starter Motor Support Bracket to Engine Oil Pan Screw	5/16-18	10
Special	Starter Motor Support Bracket to Motor Stud Nut	1/4-20	5
280M	Starter Motor to Engine Block	3/8-16	23
260M	Starter Motor Support Bracket to Engine Block	5/16-18	10
300M	Starter Motor Support Bracket to Transmission Lower Cover	5/16-18	15
260M	Battery Hold Down Screw	5/16-18	6

NOTE: Refer to back of manual, page 16-1, for bolt and nut markings and steel classification.

SPECIFICATIONS

Items	All Cars Unless Otherwise Noted
BATTERY	
Capacity, Ampere Hours	73
Plates, Number Per Cell	13
Terminal Grounded	Negative
Volts	12
Full Charge Specific Gravity 80°F	1.250-1.280
STARTING MOTOR	
Brush Spring Tension, oz.	35
Lock Amperage	435-535
Lock Voltage	3.0
Free Speed	
Volts	10.6
Amperes	70-99
RPM	7800-12,000
Cranking Power at 0°F	3350 Watts
SOLENOID SWITCH	
Hold-in Winding	14.5-16.5 amp. 10V
Both Windings	41-47 amp. 10V
GENERATOR (All Cars When Not Equipped With Air Conditioning Except Fleetwood 75 and Commercial Chassis)	
Pulley Ratio	2.78-1
Rated Output:	
Amperes	42
Volts	14
Field Current Draw:	
Amperes	2.2-2.6
Volts	12
Temperature, F°	80
GENERATOR (Fleetwood 75 Commercial Chassis and All Others When Equipped With Air Conditioner)	
Pulley Ratio	2.78-1
Rated Output:	
Amperes	55
Volts	14
Field Current Draw:	
Amperes	2.2-2.6
Volts	12
Temperature, F°	80

Items	All Cars Unless Otherwise Noted
GENERATOR (Commercial Chassis Optional Generator)	
Pulley Ratio	2.79-1
Rated Output:*	
Amperes	130
Volts	14
Field Current Draw:	
Amperes	2.2-2.4
Volts	12
Temperature, F°	80
REGULATOR (All Except Commercial Chassis with Optional Generator)	
Field Relay:	
Point Opening, Inches	.030
Voltage Regulator:	
Air Gap, Inches	.060
Point Opening, Inches	.014
Normal Range, Volts (at 125°F)	13.5-14.4
Lower Contact Point Setting, Volts (Lower Than Upper Contact Setting)	.1 to .3
REGULATOR (Commercial Chassis with Optional Generator)	
Normal Range, Volts (at 125°F)	13.6-14.3
Closing Relay Voltage	4.5-6.5
DISTRIBUTOR	
Rotation	Clockwise
Dwell Angle, Set to	30°
Range	28°-32°
Capacitor Capacity in Microfarads	.18-.23
Centrifugal Advance, Dist.	
Degrees Start	0°-4.25° at 400 RPM
Maximum	12°-16° at 2000 RPM
Timing Mark	5° BTDC
Vacuum Advance, Inches of Mercury	
Start	10.00"-12.00"
Full	18.50"
Maximum Advance	12.75°
Firing Order	1, 8, 7, 2, 6, 5, 4, 3
COIL	
Amperes Draw	
Engine Running	1.25
Primary Resistance, Ohms	1.81-1.95
Secondary Resistance Ohms	7200-9500
Primary Resistance at 80°F, Ohms (In Wiring Harness)	1.3-1.35
SPARK PLUGS	
A.C. Type Number	44
Gap, Inches	.035
Thread	14 mm
Torque	25 foot-pounds

*If generator output is checked without regulator this output may be 5% to 10% higher than the value specified.

SPECIAL TOOLS

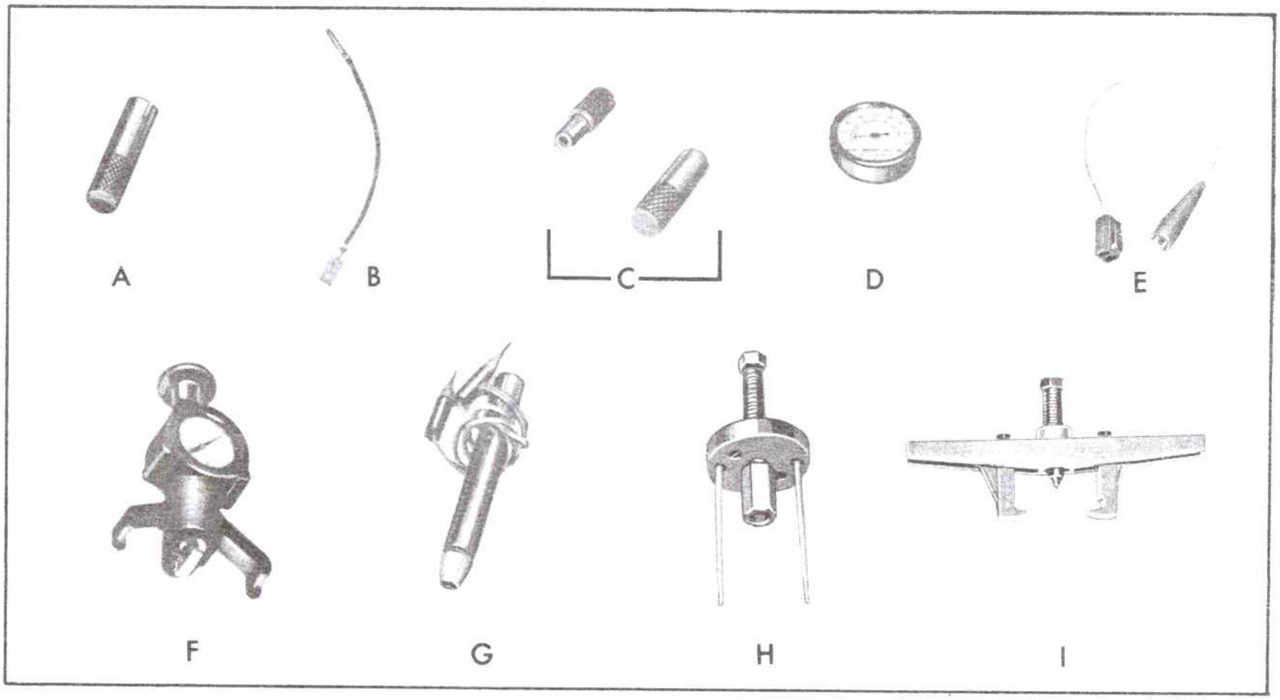


Fig. 6-72 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-9600-2	Diode Installer	E	J-21053	Generator Field Adapter
B	J-9782-1	Regulator Adapter Jumper	F	J-7316	Belt Tension Gage
C	J-9717-1 and 2	Diode Remover Set	G	J-21008	Diode Tester
D	J-8529	Voltage Regulator Temperature Gage	H	J-1859-02	Puller
			I	J-8433	Puller

GENERAL DESCRIPTION

The 1967 Cadillac engine fuel system, Fig. 6-73, covered in this section includes fuel pump, fuel line, fuel filter, carburetor and intake manifold. Also in this section are related components of these assemblies.

Fuel Requirements

The 1967 Cadillac is designed to operate efficiently on "premium" grade fuels commonly sold in the United States and Canada. Use of fuel that is too low in anti-knock quality will result in "spark knock". Since the anti-knock quality of all premium grade gasolines is not the same, and factors such as terrain and air temperature affect operating efficiency, some knocking may result in unusual circumstances even though the proper grade of fuel is used.

On cars to be used in foreign countries, there is a possibility that the best available fuels are so low in anti-knock quality that it may be necessary to lower the compression ratio of the engine. This is accomplished by installing low compression pistons, available through servicing Parts Warehouses. If persistent knocking is encountered, even with low compression pistons and the best fuel available, it may be necessary also to retard the spark timing. Engine fuel requirements are reduced by approximately one octane number for each 2-1/2 degrees that the spark timing is retarded from the normal 5 degree setting. Do not retard beyond top dead center.

Do not "power time" the engine, as variations in fuels, altitude and weather conditions will affect octane requirements. Never advance the spark beyond 5° B.T.D.C.

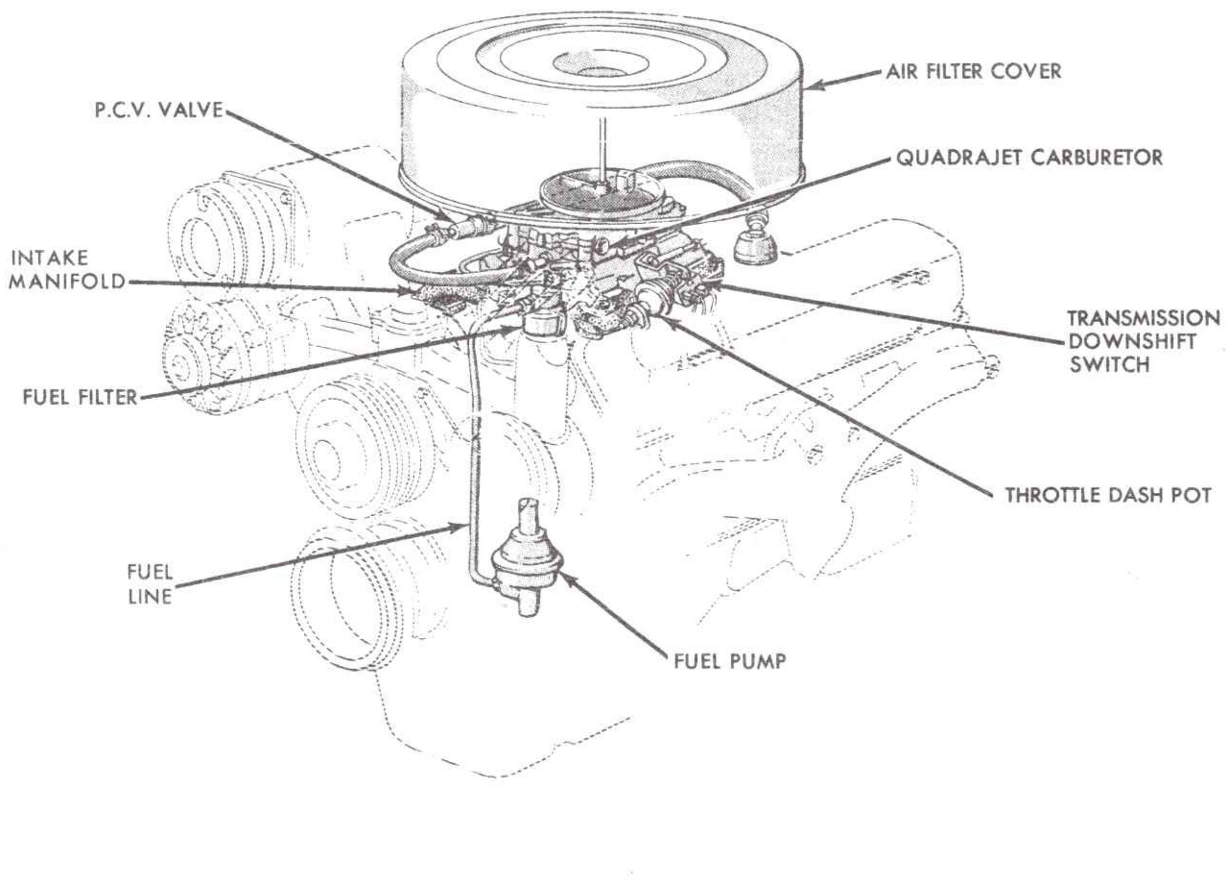


Fig. 6-73 Fuel System Components

Storage Precautions

When a car is to be put in storage for 30 days or longer, it is best to drain all gasoline from the fuel system, including the carburetor, fuel filter, fuel pump, lines and tank. This assures freedom from gum deposits that would be formed by evaporation of the fuel.

Fuel Pump

The fuel pump on all 1967 Cadillac cars is mounted on the engine front cover. The pump rocker arm is driven by an eccentric machined as an integral part of the camshaft. Fuel is drawn into the fuel pump on the upward stroke of the diaphragm as the rocker arm is moved downward by the cam eccentric working against the force of the spring. The diaphragm is forced downward by the spring during the delivery stroke of the pump and exerts pressure on the fuel equal to the spring load as the eccentric travels to minimum stroke. This design provides a smooth, even flow of fuel to the carburetor.

Most engine operating conditions do not require full travel of the diaphragm in the fuel pump. Whenever this condition occurs, a spring and link arrangement keeps the rocker arm in contact at all times with the cam eccentric while the diaphragm displaces fuel equal to engine demand.

The fuel pump is serviced as an assembly.

Fuel Filter

A fuel filter is mounted on the engine oil filler tube bracket. It receives fuel from the pump and filters out all dirt particles in excess of approximately .002 inch in diameter. This minimizes flooding and possible clogging of small passages in the carburetor.

Air Conditioner equipped cars use a fuel filter with a bypass passage that continually returns part of the fuel to the fuel tank. This bypass also returns fuel vapors that may form in the lines under high operating temperatures.

Carburetor Air Cleaner

All 1967 Cadillac cars except the Fleetwood Eldorado use a carburetor air cleaner incorporating a replaceable paper element to remove dirt from the air before it enters the carburetor and engine. A new paper air cleaner element should be installed in these cars every 24,000 miles.

The Fleetwood Eldorado uses an oil wetted polyurethane air cleaner element that should be cleaned and reoiled every 12 months or 12,000 miles.

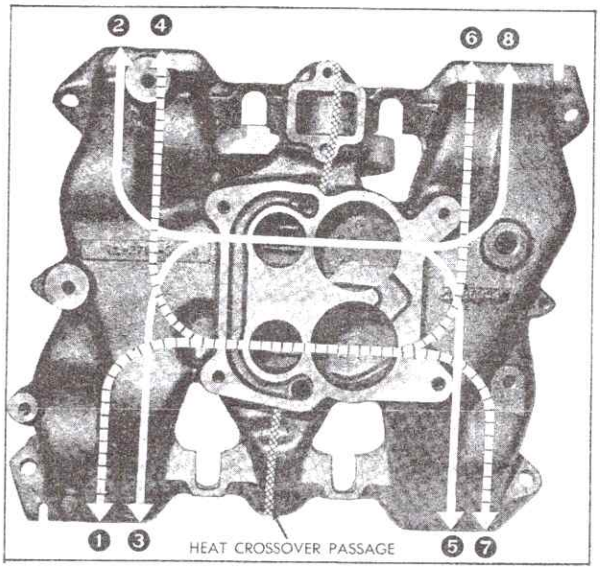


Fig. 6-74 Intake Manifold

More frequent replacement of the paper element or service of the oil wetted element may be necessary if the car is constantly driven in dusty areas.

Fuel Intake Manifold

The intake manifold is designed to provide passages that are short and nearly equal in length. Each pair of bores feeds fuel to four cylinders as shown in Fig. 6-74.

During engine warmup, the intake manifold is heated by exhaust gases passing from the right cylinder bank to the left through a crossover passage cast into the center of the manifold. Pre-heating the fuel-air mixture in this manner contributes to uniform fuel distribution and more complete vaporization.

A thermostatically controlled heat valve is located at the junction of the right exhaust manifold and exhaust pipe. It controls the flow of exhaust gases from the right cylinder head. During the engine warmup period, the valve is closed, forcing the hot exhaust gases through a ribbed heat passage in the intake manifold to heat the intake air-fuel mixture.

A branch of this passage conducts exhaust gases up to the carburetor base. These hot gases warm the carburetor in the region of the primary throttle valves and idle ports to prevent stalling due to ice formation during engine warm-up on cool, humid days. Better performance and economy are thereby provided when the engine is cold.

Transmission Downshift Switch

All cars utilize a rotary transmission downshift switch that is activated through the throttle adapter plate at certain angles of throttle opening.

The switch is located at the left of the carburetor and secured by two cap screws to a support

bracket attached to the intake manifold. It has three electrical leads for two circuits: one circuit is energized at 40 degrees of primary throttle opening, and the other at 60 degrees of primary throttle opening. Adjustment of the switch is covered in Note 96 of this Section.

Air Condition Idle Speed-Up

Cars equipped with air conditioning have a vacuum-operated idle speed-up control attached to the carburetor. This device increases the engine idle rpm to 900 when the Air Conditioner is "On" and the power servo unit operating arm is between 0 and 13 degrees in an increasing vacuum, and 9 degrees to 0 degrees in a decreasing vacuum. This provides adequate interior cooling and guards against possible engine overheating during idling while in neutral or park.

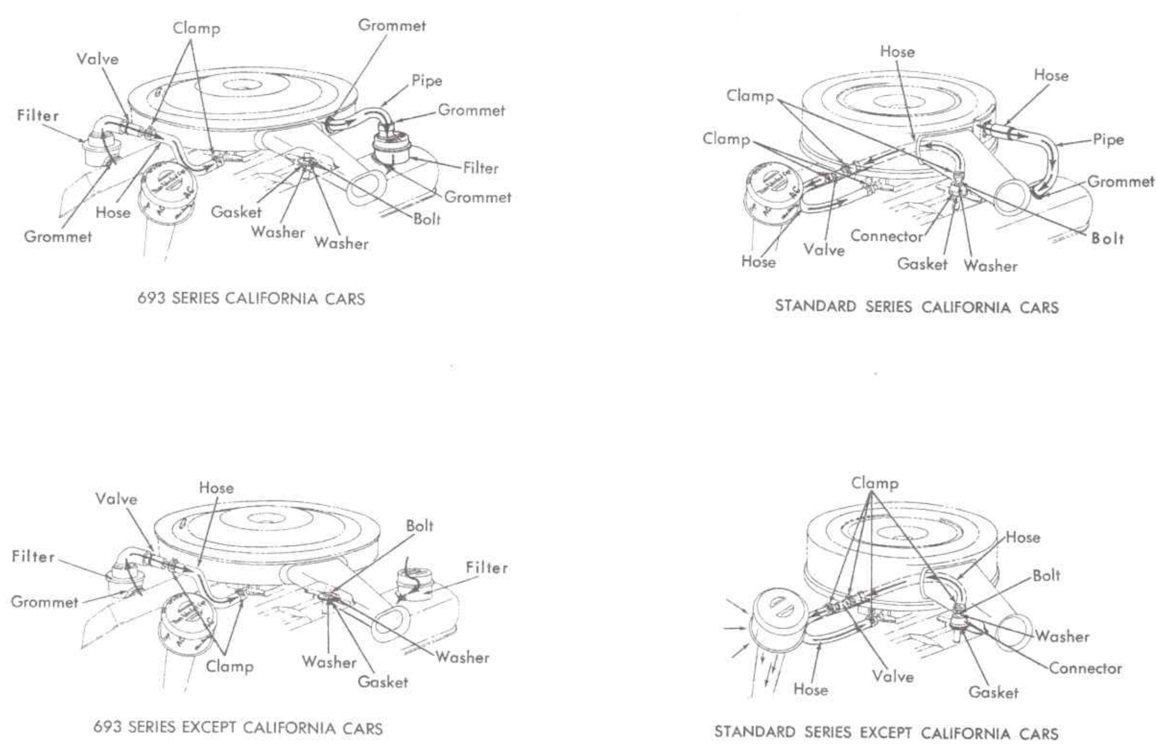
Throttle Dash Pot

Certain transmission and vehicle speed conditions are such that sudden release of accelerator pedal pressure might cause the engine to return too quickly to idle speed, with subsequent stalling of the engine; to prevent this stalling, a throttle dash pot assembly is incorporated ahead of the throttle linkage.

Crankcase Ventilating Systems (Fig. 6-75)

Crankcase ventilation on all 1967 Cadillac engines is designed to reduce the amount of contaminating hydrocarbons permitted to enter the atmosphere. This is accomplished by venting the vapors from the crankcase through a vacuum controlled ventilating valve into the intake manifold where they mix with the fuel and are burned in the combustion process. See Fig. 6-75.

Two systems of ventilation are used, a closed system and an open system, both use the positive crankcase ventilation (PCV) valve in addition to following external modifications. One design (closed system) used on all cars shipped to California, incorporates a closed oil filler cap,



693 SERIES CALIFORNIA CARS

STANDARD SERIES CALIFORNIA CARS

693 SERIES EXCEPT CALIFORNIA CARS

STANDARD SERIES EXCEPT CALIFORNIA CARS

Fig. 6-75 Crankcase Ventilating Systems

(orange color with "Non-Vented Cap" printed on it), a crankcase filter in the air cleaner and an external line between this filter and the left rocker cover. In the Eldorado series, the crankcase breather filter is mounted on the left rocker cover and an external line connects this filter to the air cleaner.

The other type (open system) does not use any external pipes to the air cleaner and is used on all other Cadillacs as follows: on all series except Eldorado a black, filter type oil filler cap (breather cap) is used. In the Eldorado series a closed type oil filler cap (orange color with "Non-Vented Cap" printed on it) is used and a crankcase breather is mounted on the left rocker arm cover. Fresh air to the crankcase enters through this breather.

NOTE: Never install a closed-type cap on a car equipped with a filter type cap. Doing so will prevent crankcase ventilation and could result in engine oil seal failure, engine rusting and other major engine damage. Do not install a filter type cap on any Eldorado Series car. Improper crankcase ventilation will occur with possible engine damage.

The PCV valve on all cars except the Eldorado series is mounted in the hose from the rear of the crankcase to the carburetor and retained in the clip at the center of the right rocker arm cover.

In the Eldorado series the PCV valve is installed in an elbow mounted in an oil separator in the right rocker arm cover.

NOTE: This separator and the crankcase breather used in the left rocker arm cover in the closed system are identical.

The critical point in both the open and closed crankcase ventilating systems is the ventilator valve. This valve controls the flow of fumes entering the intake manifold. It must be replaced every 12,000 miles, or every 12 months, whichever occurs first. Other components of the system should be inspected, cleaned or replaced every 12,000 miles or 12 months, whichever occurs first.

The ventilator valve, Fig. 6-76, is held closed by spring pressure when the engine is not running. This prevents an accumulation of hydrocarbon laden fumes from collecting in the manifold when the engine is stopped, which could result in hard starting.

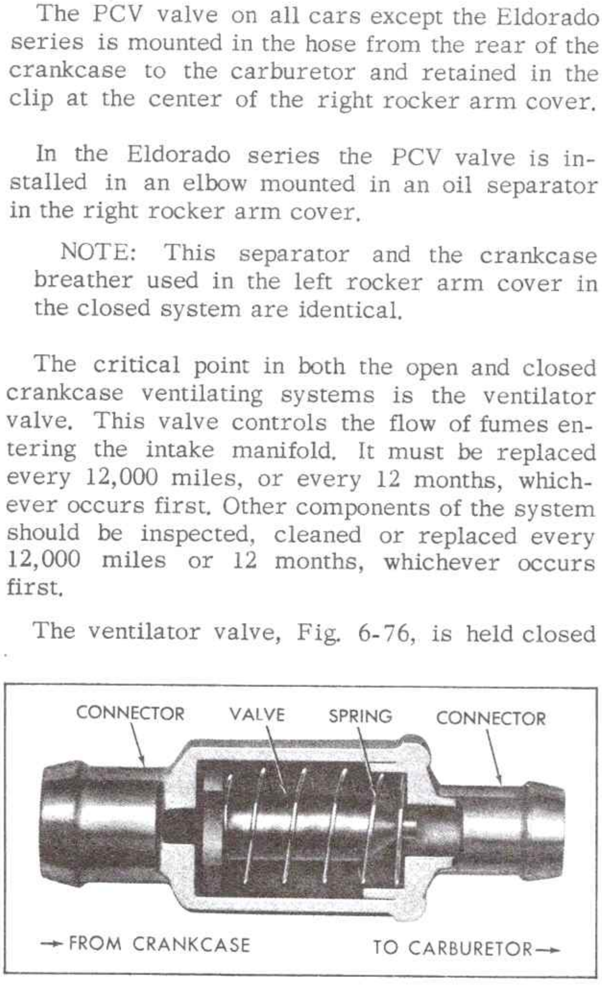


Fig. 6-76 P.C.V. Valve

As soon as the engine is started, manifold vacuum pulls the valve open against the spring pressure and, as long as the engine vacuum is below 14.9 inches of mercury, the valve "floats", permitting crankcase fumes to enter the intake manifold.

Open Positive Crankcase Ventilation

Operation of the system (except Eldorado series) with the open, filter-equipped oil filler cap is as follows: air entering the system first passes through the breather cap, Fig. 6-75, which contains an oil soaked, aluminum ribbon filter to remove air-borne dust and foreign particles. It then flows down the oil filler tube, through the timing gear compartment, the valve lifter compartment and crankcase. Hydrocarbons, consisting of unburned fuel-air mixture (blow-by) and oil vapors, are picked up from the crankcase and carried through openings in the rear of the cylinder block between the lower part of the crankcase and the valve lifter compartment and in the front of the block through an opening between the timing gear cover and valve lifter compartment.

The fumes are then circulated toward the front of the valve lifter compartment and forced out through the valve lifter compartment cover channel to the connector at the rear of the cover. From here they pass through the connector and hose to the ventilator valve. This valve opens, in varying degrees, when the engine is running and directs fumes through the carburetor into the intake manifold, where they are added to the normal fuel and air mixtures and burned.

In the Eldorado series air entering the system first passes through a crankcase filter mounted at the rear of the left rocker arm cover which contains an oil-soaked aluminum ribbon filter to remove air-borne dust and particles. It then flows into the valve lifter compartment and is mixed with engine blowby. The fumes are forced through an oil separator mounted on the right rocker arm cover at the front, through an elbow and the PCV valve mounted in the separator, then through the carburetor and into the intake manifold to be burned with the air fuel mixture. The oil filler cap is the orange colored non-ventilating cap.

The ventilator valve, Fig. 6-76, is held closed by spring pressure when the engine is not running. This prevents an accumulation of hydrocarbon laden fumes from collecting in the manifold when the engine is stopped, which could result in hard starting.

As soon as the engine is started, manifold vacuum pulls the valve open against the spring pressure and, as long as the engine vacuum is below 14.9 inches of mercury, the valve "floats", permitting crankcase fumes to enter the intake manifold.

During periods of high manifold vacuum (above 14.9 inches), the valve floats in the opening against spring pressure, leaving only a small annular opening to the manifold. This prevents large amounts of hydrocarbons from entering the air-fuel mixture and upsetting the fuel-air ratio necessary for smooth engine performance, as well as maintaining adequate crankcase ventilation at idle.

In the event of an engine "backfire", the pressure created in the intake manifold will push the valve back against its seat, preventing the "backfire" from reaching the engine crankcase.

In time, blow-by and oil and water vapor deposits may accumulate on the valve, causing it to stick, thus plugging or restricting the breathing system so that fumes in the crankcase cannot be removed properly. When the valve is stuck closed, backflow may occur, forcing oil vapors out of the breather cap into the engine compartment. If the valve is restricted or stuck closed, inadequate ventilation also will result. Sludge, varnish, and acids will develop in the crankcase and cause premature wear on engine parts if the crankcase is not properly ventilated.

Carburetion problems will also occur when the fumes are not properly expelled. Poor idling conditions and engine stalling may result. Even with a properly functioning positive crankcase ventilator valve, rough idling may occur if idle is adjusted too low. Proper engine idle adjustment with an accurate tachometer is extremely important for engines equipped with positive crankcase ventilation.

The Cadillac positive crankcase ventilator valve is not interchangeable with those of other makes. Use of other than the proper valve may result in inadequate ventilation and possible engine damage.

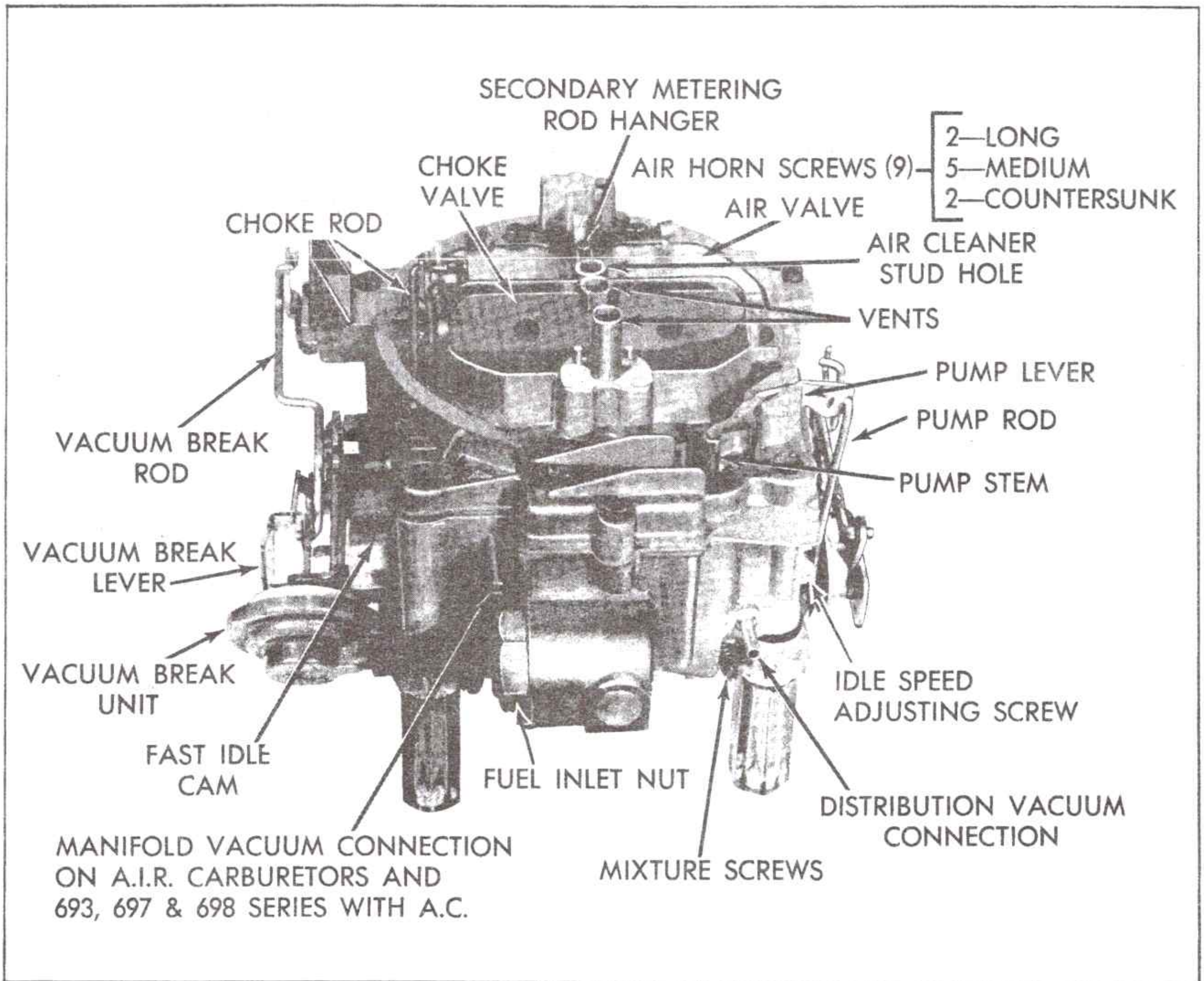


Fig. 6-77 Quadrajet 4MV Carburetor

On cars equipped with the filter type oil filler cap or Eldorado crankcase filter, the cleaning of these parts is very important. Since all the air entering the crankcase must pass through these filters, any restriction will eventually affect engine ventilation and internal cleanliness.

Closed Positive Crankcase Ventilation

The closed-type ventilation system uses a non-ventilated oil filler cap (orange color), an air cleaner strainer, and an air cleaner-to-rocker arm cover hose and pipe, along with the positive crankcase ventilator valve and hose. One end of the hose and pipe is attached to the strainer, which is located inside the air cleaner on all 1967 Cadillac cars except the Eldorado and the other end into the left rocker arm valve cover. The Eldorado uses a strainer mounted on the left rocker arm cover instead of being inside of the air cleaner. This strainer is connected by a pipe to the air cleaner.

Operation of the closed positive crankcase ventilator is as follows: air enters the system through the air cleaner to the strainer, Fig. 6-75, which contains an oil soaked ribbon filter either in the carburetor air cleaner or on the left rocker arm cover. It then flows into the rocker arm cover, into the valve lifter compartment and combines with the blow-by gas consisting of exhaust gas and unburned air-fuel mixture.

In all cars except the Eldorado the fumes are then circulated toward the front of the valve lifter compartment and forced out through the valve lifter compartment cover channel to the connector at the rear of the cover.

At this point the fumes pass through a connector and hose to the ventilator valve Fig. 6-76. The valve directs fumes through the base of the carburetor and into the intake manifold where they are added to the normal fuel and air mixtures and burned.

In the Eldorado series the fumes are circulated through the valve lifter compartment and forced through an oil separator mounted on the right rocker arm cover, PCV valve and hose to the base of the carburetor and into the intake manifold where it is mixed with the fuel and air and burned. The opening at the rear of the tappet valley cover is sealed in the Eldorado series.

During certain engine operations where more blow-by is created than the ventilator valve can handle, the excess amount is returned to the air cleaner and to the carburetor by way of the rocker-arm-valve-cover pipe and strainer and burned in the engine, instead of being released out of the oil filler cap into the atmosphere as in the open system.

The strainer in the air cleaner or crankcase filter should be cleaned in solvent and reoiled with engine oil whenever the engine oil is changed.

This system used a closed-type oil filler cap which is painted a distinctive orange color and has "Non-Vented Cap" printed on it.

General Description Cadillac Quadrajet Carburetor (Fig. 6-77)

The four barrel Quadrajet carburetor used on all 1967 Cadillac cars has two stages of operation. The primary (fuel inlet) side has small bores with a triple venturi set-up equipped with plain tube nozzles. Its metering principles are similar to most plain tube carburetors using the venturi principle. The triple venturi stack up, plus the smaller primary bores, give a stable fuel control in the idle and economy ranges of operation. Fuel metering in the primary side is accomplished with tapered metering rods positioned by a manifold vacuum responsive piston.

The secondary side has two very large bores. The air valve principle is used in the secondary side for metering control and supplements fuel flow from the primary bores.

Using the air valve principle, fuel is metered in direct proportion to the air passing through the secondary bores.

The fuel reservoir (bowl) is centrally located. The float system uses a single float pontoon. The float needle has a synthetic tip which gives added insurance against flooding problems caused by dirt.

The primary side of the carburetor has six systems of operation. They are float, idle, main metering, power, pump, and choke. The secondary side has one metering system which supplements the primary main metering system and receives fuel from a common float chamber.

Float System (Figs. 6-78 and 6-79)

The Quadrajet carburetor has a centrally located float reservoir with a single pontoon float and a conventional float needle valve and seat. The fuel bowl is centered between the primary bores and is adjacent to the secondary bores as shown in Fig. 6-79.

The float pontoon is solid and is made of a closed cellular plastic material.

The float system consists of a float chamber, plastic float pontoon assembly, float hinge pin, a float needle valve and seat, and a float valve pull clip. The float system operates as follows:

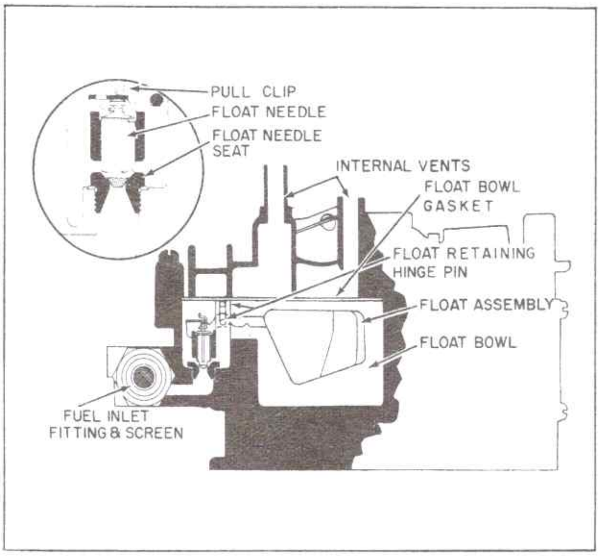


Fig. 6-78 Float System

Fuel from the engine fuel pump enters the carburetor fuel inlet passage. It passes through the inlet screen, and needle seat.

As fuel fills the float bowl to the prescribed fuel level, the float pontoon rises and forces the fuel inlet valve closed, shutting off all fuel flow. As fuel is used from the float chamber, the float drops and allows more incoming fuel to enter the float bowl until the correct fuel level is reached. This cycle continues, constantly maintaining a positive fuel level in the float bowl.

A float needle pull clip, fastened to the float valve, hooks over the center of the float arm. Its purpose is to assist in lifting the float valve off its seat.

A plastic filler block is located in the top of the float chamber in the area just above the float valve. This block prevents fuel slosh on severe brake applications or turning maneuvers. This maintains a constant fuel level during these maneuvers, to prevent stalling.

The carburetor float chamber is internally vented. The internal vent tubes are located in the primary bore section of the carburetor air horn just above the float chamber. The purpose of the internal vent is to balance incoming air pressure beneath the air cleaner with air pressure acting on fuel in the float bowl. Therefore, a balanced air/fuel mixture ratio can be maintained during part throttle and power operation because the pressure acting upon the fuel in the float bowl will be balanced with the air flow through the carburetor bores. The internal vent tubes allow the escape of fuel vapors in the float chamber during hot engine operation. This prevents fuel vaporization from causing excessive pressure build-up in the float bowl, which can result in excessive fuel spillage into the manifold.

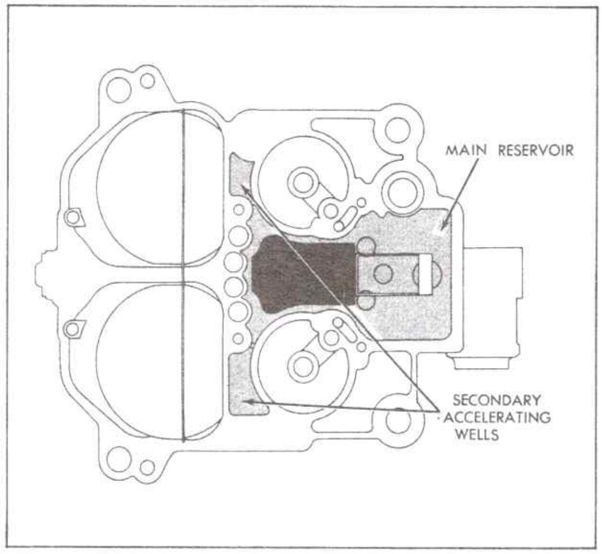


Fig. 6-79 Single Reservoir Float Bowl

Idle System (Fig. 6-80)

The Quadrajet carburetor has an idle system on the primary side (fuel inlet side) of the carburetor to supply the correct air/fuel mixture ratios during idle and off-idle operation. The idle system is used during this period because air flow through the carburetor venturi is not great enough to obtain efficient metering from the main discharge nozzles.

The idle system is used only in the two primary bores of the carburetor. Each bore has a separate and independent idle system. They consist of idle tubes, idle passages, idle air bleeds, idle channel restrictions, idle mixture adjustment needles, and idle discharge holes.

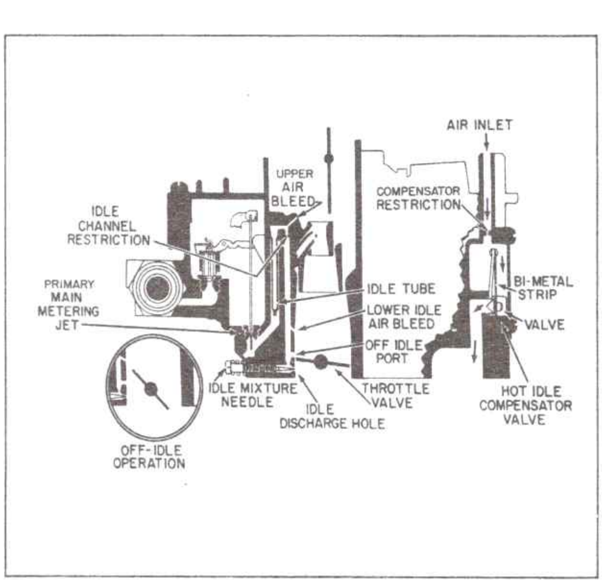


Fig. 6-80 Idle System

During curb idle, the throttle valve is held slightly open by the idle speed adjusting screw. The small amount of air which passes between the primary throttle valve and bore is regulated by this screw to give the engine the desired idle speed. Since the engine requires very little air for idle and low speeds, fuel is added to the air to produce a combustible mixture by the direct application of vacuum (low pressure) from the engine manifold to the idle discharge hole below the throttle valve. With the idle discharge holes in a very low pressure area and the fuel in the float bowl vented to atmosphere (high pressure), the idle system operates as follows:

Fuel is forced from the float bowl down through the primary metering jets into the main fuel well. It passes from the main fuel well into the idle passage where it is picked up by the idle tubes.

The fuel is metered at the tip of the idle tubes and passes up through the idle tubes. The fuel then crosses over in the air horn to the idle down channels. Air is bled in here through a calibrated idle restriction. The mixture passes down through the channel restriction.

This mixture then passes down the idle channel past the lower idle air bleed holes and off-idle discharge ports, located just above the primary throttle valves, where it is mixed with more air. The air/fuel mixture moves down to the idle needle discharge holes, where it enters the carburetor bores and mixes finally with air passing around the slightly open throttle valve. It then enters the intake manifold and is conducted to the engine cylinders as a combustible mixture.

The idle mixture needles are adjustable and control the amount of fuel mixed with the air going to the engine. Turning the mixture screw clockwise (inward) decreases the fuel discharge (gives a leaner mixture) and turning the mixture screw counter-clockwise (outward) increases (enrichens) the idle fuel mixture.

Off Idle Operation

As the primary throttle valves are opened from curb idle to increase engine speed, additional fuel is needed to combine with the extra air entering the engine. This is accomplished by the slotted off-idle discharge ports. As the primary throttle valves open, they pass by the off-idle ports, gradually exposing them to high engine vacuum below the throttle valves. The additional fuel added from the off-idle ports mixes with the increasing air flow past the opening throttle valves to meet increased engine air and fuel demands.

Further opening of the throttle valves increases the air velocity through the carburetor venturi sufficiently to cause low pressure at the lower idle air bleeds. As a result, fuel begins to discharge from the lower idle air bleed holes and continues to do so throughout operation of the part throttle to wide open throttle ranges, supplementing the main discharge nozzle delivery.

The idle needle holes and off-idle discharge ports continue to supply sufficient fuel for engine requirements until air velocity is high enough in the venturi area to obtain efficient fuel flow from the main metering system.

Hot Idle Compensator

The hot idle compensator is located in a chamber at the rear of the carburetor float bowl adjacent to the secondary bores. Its purpose is to offset enriching effects caused by excessive fuel vapors during hot engine operation.

The compensator consists of a thermostatically controlled valve, a bi-metal strip which is heat sensitive, a valve holder and bracket. The valve closes off an air channel which leads from a hole in the top of the air horn, just beneath the air cleaner, to a point below the secondary throttle valves.

Normally the compensator valve is held closed by tension of the bi-metal strip. During extreme hot engine operation excessive fuel vapors entering the engine manifold cause richer than normally required mixtures, resulting in rough engine idle and stalling. At a predetermined temperature, when extra air is needed to offset the enriching effects of fuel vapors, the bi-metal strip bends and unseats the compensator valve. This uncovers the air channel leading from the valve chamber to the point below the throttle valves. This allows enough air to be drawn through a calibrated orifice into the engine manifold to offset the richer mixtures and maintain a smooth engine idle. When the engine cools and the extra air is not needed, the bi-metal strip closes the valve and operation returns to normal mixtures.

The compensator valve assembly is held in place by the dust cover over the valve chamber. A seal is used between the compensator valve and the float bowl casting.

In order to insure proper idle adjustment when the engine is hot, the compensator valve must be closed. To check this, a finger may be held over the compensator air inlet channel located on top of the air horn. If no suction is felt nor drop in engine RPM is noted on a tachometer, the valve is closed. If the valve is open, plug the hole or cool engine down to a point where the valve automatically closes for proper idle adjustment.

NOTE: Plug the compensator hole with a pencil or something that will be seen, as the plug must be removed before the air cleaner is

installed. Otherwise the compensator will not function if the plug is left in the hole.

Main Metering System (Fig. 6-81)

The main metering system supplies fuel to the engine from off-idle to wide open throttle operation. The Quadrajet carburetor has two bores that feed fuel and air during this range. The two primary bores of the carburetor meter fuel through the venturi principle. This design allows the use of multiple venturi for finer and more stable metering control during light engine loads.

The main metering system is in operation at all times when air flow through the venturi is high enough to maintain efficient fuel flow from the main fuel discharge nozzles. It begins to feed fuel when the idle system can no longer meet the engine requirements.

The main metering system consists of main metering jets; vacuum operated metering rods; main fuel well; main well air bleeds; fuel discharge nozzles; and triple venturi. The system operates as follows:

During cruising speeds and light engine loads, engine manifold vacuum is high. Manifold vacuum holds the main metering rods down in the main metering jets against spring tension. Manifold vacuum is supplied through a channel to the vacuum operated power piston connected to the primary main metering rods. Fuel flow from the float bowl is metered between the metering rods and the main jet orifice.

As the primary throttle valves are opened beyond the off-idle range allowing more air to enter the engine manifold, air velocity increases in the carburetor venturi. This causes a drop in pressure in the large venturi which is increased many times in the double boost venturi. Since the low pressure (vacuum) is now in the smallest boost venturi, fuel flows from the main discharge nozzles as follows:

Fuel flows from the float bowl through the main metering jets into the main fuel well and is bled with air from the vent at the top of the main well and side bleeds. The fuel in the main well is mixed with air from the main well air bleeds and then passes through the main discharge nozzle into the boost venturi. At the boost venturi the fuel mixture then combines with the air entering the engine through the carburetor bores and passes through the intake manifold and on into the engine cylinder as a combustible mixture.

Power System (Fig. 6-82)

The power system in the Quadrajet carburetor provides mixture enrichment for power requirements under acceleration or high speed operation.

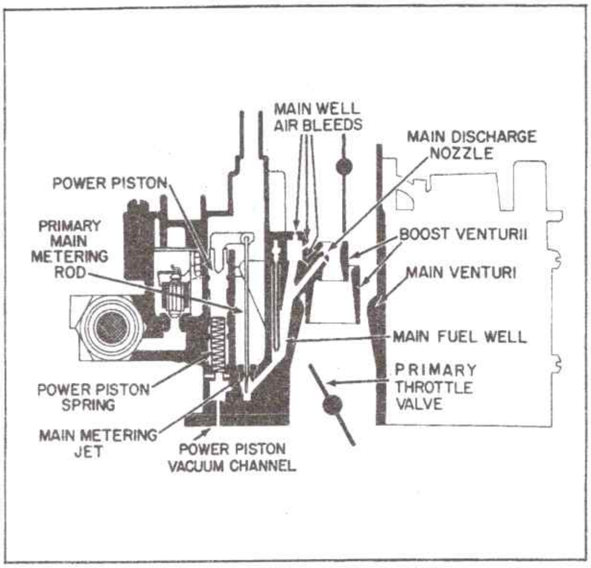


Fig. 6-81 Main Metering System

The richer mixture is supplied through the main metering system in the primary and secondary sides of the carburetor.

The power system located in the primary side consists of a vacuum piston and spring located in a cylinder connected by a passage to intake manifold vacuum. The spring located beneath the vacuum operated power piston tends to push the piston upward against manifold vacuum.

On part throttle and cruising ranges, manifold vacuum is sufficient to hold the power piston down against spring tension so that the larger diameter of the metering rod tip is held in the main metering jet orifice. Mixture enrichment is not necessary at this point. However, as engine load is increased to a point where mixture enrichment is required, the spring tension overcomes the vacuum pull on the power piston and the tapered primary metering rod tip moves upward in the main metering jet orifice. The smaller diameter of the metering rod tip allows more fuel to pass through the main metering jet and enrich the mixture flowing into the primary main wells and out the main discharge nozzles.

When manifold vacuum rises and mixture enrichment is no longer needed, the vacuum overcomes the power piston spring tension and returns the larger portion of the metering rod into the metering jet orifice and back to normal economy ranges. However, as the engine speed increases further, the primary side of the carburetor can no longer meet the engine air and fuel requirements. To meet these demands, the secondary side of the carburetor is used. The secondary side contains throttle valves, spring loaded air valves, metering orifice plates, secondary metering rods, main fuel wells with air bleed tubes, fuel discharge nozzles, and accelerating wells and tubes. The secondary side operates as follows:

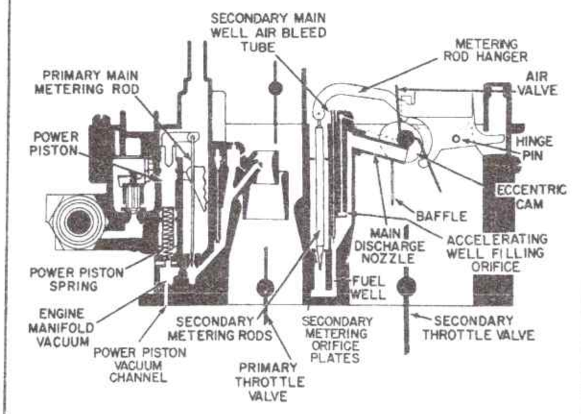


Fig. 6-82 Power System

When the engine reaches a point where the primary bores cannot meet engine air and fuel demands, the primary throttle lever, working through connecting linkage to the secondary throttle shaft lever, begins to open the secondary throttle valves. As air flow through the secondary bores creates a low pressure (vacuum) beneath the air valve, atmospheric pressure on top of the air valve forces the air valve open against spring tension. This allows the required air for increased engine speed to flow past the air valve.

When the air valve begins to open, the upper edge of the air valve passes the accelerating well port. As the valve passes the port it exposes the port to manifold vacuum. The port will immediately start to feed fuel from the accelerating wells.

The accelerating ports will prevent a momentary leanness as the valve opens and the secondary nozzles have not begun to feed fuel.

The secondary main discharge nozzles (one for each secondary bore) are located just below the air valve and above the secondary throttle valves. Being in the area of lowest pressure, they begin to feed fuel as follows:

When the air valve begins to open, it rotates a plastic cam attached to the center of the main air valve shaft. The cam pushes upward on a lever attached to the secondary main metering rods, raising the metering rods out of the secondary orifice plates. Fuel flows from the float chamber through the secondary orifice plates into secondary main wells, where it is mixed with air from the main well tubes at the bottom of the main wells. The air-blended-fuel mixture travels from the main wells to the secondary discharge nozzles and into the secondary bores. Here fuel mixture is mixed with air traveling through the secondary bores to supplement the air/fuel mixture delivered from the primary bores, and then goes on into the engine manifold and on to the engine cylinders as a combustible mixture.

As the throttle valves are opened further, and engine speeds increase, increased air flow through the secondary side of the carburetor opens the air valve to a greater degree, which in turn lifts the secondary metering rods further out of the orifice plates. The metering rods are tapered so that fuel flow through the secondary metering orifice plates is directly proportional to air flow through the secondary carburetor bores. In this manner correct air/fuel mixtures to the engine through the secondary bores can be maintained by the depth of the metering rods in the orifice plates.

There are three other features incorporated in the secondary metering system which are as follows:

1. The main well bleed tubes extend below the fuel level in the main well. These bleed air into the fuel in the well to blend the fuel with air quickly for good atomization as it leaves the secondary discharge nozzles.

2. The secondary metering rods have a slot milled in the side to insure adequate fuel supply in the secondary fuel wells. These are necessary because, when the air valve is in the closed position, the secondary metering rods are nearly seated against the secondary metering orifice plates. During hot engine idle or hot soak the fuel could boil out of the fuel well. The milled slot allows enough fuel to by-pass the orifice plate to keep the main well filled during this period. This insures immediate fuel delivery from the secondary fuel wells at all times.

3. A baffle plate is used in the secondary bores. Its purpose is to provide good fuel distribution by preventing too much fuel from going to the front of the engine.

Air Valve Dashpot Operation (Fig. 6-83)

The secondary air valve is connected to a dashpot (called the vacuum break unit) by a rod, to control the opening rate of the air valve and prevent any secondary discharge nozzle lag.

Whenever manifold vacuum is above approximately 5" - 6" Hg, the vacuum break diaphragm stem is seated. However, when the secondary valves are opened and manifold vacuum drops below the 5" - 6" point, the spring in the vacuum break unit will force the diaphragm and stem off its seat. The rate of movement off the seat is controlled by a restriction in the cover of the vacuum break unit.

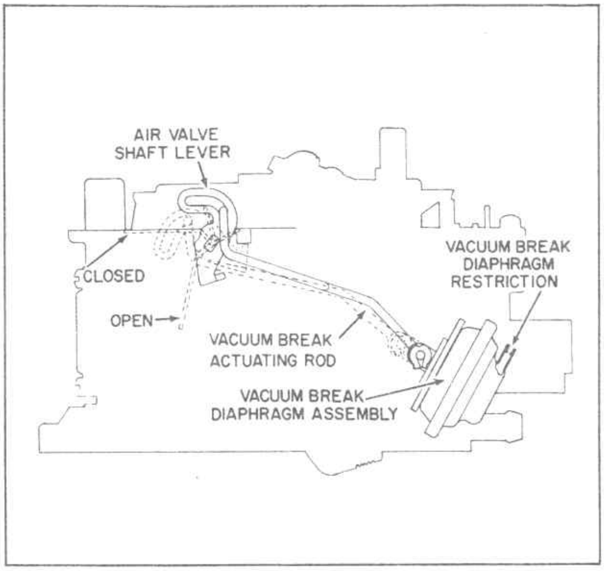


Fig. 6-83 Air Valve Dashpot Operation

When the diaphragm is seated, it pulls the rod to the end of the slot in the air valve shaft lever. As the air valve starts to open, when the secondary valves are opened, the restriction in the cover will restrict the air movement to the back side of the diaphragm and slow down the opening of the air valve.

Accelerating Pump System (Fig. 6-84)

During quick acceleration, when the throttle is opened rapidly, the air flow and manifold vacuum change almost instantaneously. The fuel, which is heavier, tends to lag behind causing a momentary leanness. The accelerator pump is used to provide the extra fuel necessary for smooth operation during this time.

The accelerating pump system is located in the primary side of the carburetor. It consists of a spring loaded pump plunger and pump return spring, operating in a fuel well. The pump plunger is operated by a pump lever on the air horn which is connected directly to the throttle lever by a pump rod.

When the pump plunger moves upward in the pump well, as happens during throttle closing, fuel from the float bowl enters the pump well through a slot in the top of the pump well. It flows past the synthetic pump cup seal into the bottom of the pump well. The pump cup is a floating type, which moves up and down on the pump plunger head. When the pump plunger is moved upward, the flat on top of the cup unseats from the flat on the plunger head and allows free movement of fuel through the inside of the cup into the bottom of the pump well. This also vents any vapors which may be in the bottom of the pump well so that a solid charge of fuel can be maintained in the fuel well beneath the plunger head.

When the primary throttle valves are opened, the connecting linkage forces the pump plunger downward. The pump cup seats instantly and fuel is forced through the pump discharge passage, where it unseats the pump discharge check ball and passes on through the passage to the pump jets located in the air horn where it sprays into the venturi area of each primary bore.

It should be noted the pump plunger is spring loaded. The upper duration spring is balanced with the bottom pump return spring so that a smooth sustained charge of fuel is delivered during acceleration.

The pump discharge check ball seats in the pump discharge passage during upward motion of the pump plunger so that air will not be drawn into passage; otherwise, a momentary acceleration lag could result.

During high speed operation, a vacuum exists at the pump jets. A cavity just beyond the pump jets is vented to the top of the air horn, outside the carburetor bores. This acts as a suction breaker so that when the pump is not in operation fuel will not be pulled out of the pump jets into the venturi area. This insures a full pump stream when needed and prevents any fuel "pull over" from the pump discharge passage.

Choke System (Fig. 6-85)

The Quadrajet choke valve is located in the primary side of the carburetor. It provides the correct air/fuel mixture enrichment to the engine for quick cold engine starting and during the warm-up period. The air valve is locked partially closed until the engine is thoroughly warm and choke valve is wide open. The air valve can open a maximum of 8° during warm-up to permit increased performance during warm-up.

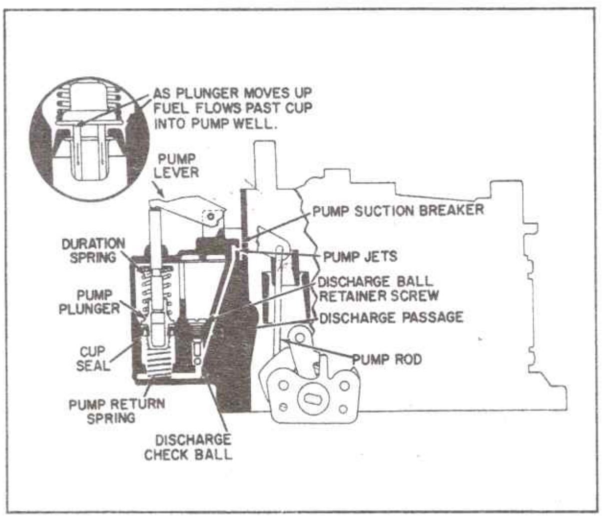


Fig. 6-84 Accelerating Pump System

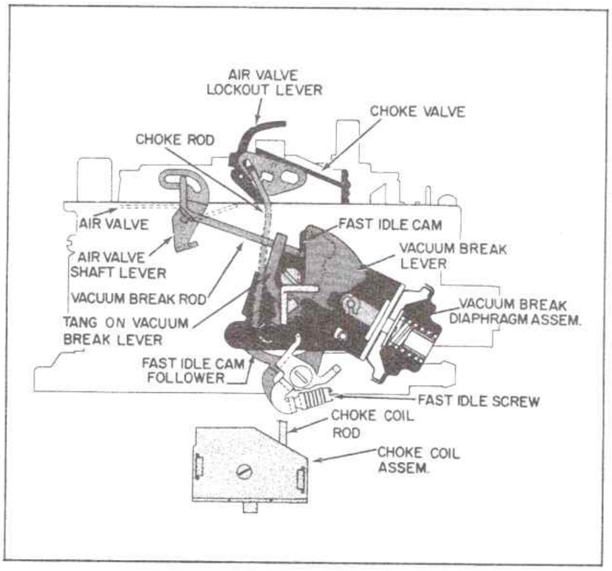


Fig. 6-85 Choke System

The choke system consists of a choke valve located in the primary air horn bore, a vacuum diaphragm unit, fast idle cam, connecting linkage, air valve lockout lever and a thermostatic coil. The thermostatic coil is located on the engine manifold and is connected to the intermediate choke shaft and lever assembly. Choke operation is controlled by the combination of intake manifold vacuum, the off-set choke valve, temperature, and throttle position.

The thermostatic coil located on the engine manifold is calibrated to hold the choke valve closed when the engine is cold.

NOTE: To close the choke valve the primary throttle valves have to be opened to allow the fast idle cam follower to by-pass the steps on the fast idle cam and come to rest on the highest step of the fast idle cam.

When the choke valve is closed, the air valve lock-out lever is weighted so that a tang on the lever catches the upper edge of the air valve and keeps the air valve almost closed.

During engine cranking, the choke valve is held closed by the tension of the thermostatic coil. This restricts air flow through the carburetor to provide a richer starting mixture. When the engine starts and is running, manifold vacuum applied to the vacuum diaphragm unit mounted on the float bowl will open the choke valve to a point where the engine will run without loading or stalling.

At the same time, the fast idle cam follower lever on the end of the primary throttle shaft will drop from the highest step on the fast idle cam to a lower step when the throttle is opened. This gives the engine sufficient fast idle and correct fuel mixture for running until the engine begins to warm up and heat the thermostatic coil. As the thermostatic coil on the engine manifold becomes heated, it relaxes its tension and allows the choke valve to open further because of intake air pushing on the off-set choke valve and the counterweight effect of the linkage and choke lever. Choke valve opening continues until the thermostatic coil is completely relaxed at which point the choke valve is wide open.

When the engine is thoroughly warm, the choke coil pulls the intermediate choke lever completely down and allows the fast idle cam to rotate so that the cam follower drops off the last step of the fast idle cam allowing the engine to run at normal speeds. When the choke shaft lever moves toward the up position, the end of the rod strikes a tang on the air valve lock-out lever. As the rod moves to the end of its travel, it pushes the lock-out tang upward and unlocks the air valve.

The choke system is equipped with an unloader mechanism which is designed to open the choke valve partially if the engine should become loaded or flooded. To unload the engine, the accelerator pedal must be depressed so that the throttle valves are held wide open. A tang on a lever on the choke side of the primary throttle shaft contacts the fast idle cam and through the intermediate choke shaft forces the choke valve slightly open. This allows extra air to enter the carburetor bores and pass into the engine manifold and cylinders to lean out the fuel mixture so that the engine will start.

SERVICE INFORMATION

66. Carburetor Removal

1. Remove air cleaner, mounting stud and gasket.

2. Disconnect fuel line at carburetor and fuel filter bowl.

3. Disconnect choke coil rod from carburetor by removing choke housing to manifold attaching screw and carefully lift choke coil assembly out of pocket and remove rod from hole in lever.

4. Disconnect distributor vacuum line from front of carburetor. If car is a 697 or a 693 series with air conditioning, also disconnect second vacuum line from front of carburetor 3/16" body fitting.

5. Disconnect throttle return springs and throttle rod or cable at throttle adapter plate.

6. Disconnect vacuum hose at PCV valve. On cars with Automatic Leveling Control, disconnect hose from tee.

7. On cars equipped with A.I.R. system, disconnect hoses from 5/8" fitting at rear of carburetor and 3/16" fitting or tee at front of carburetor.

8. Remove two front screws and two rear bolts that hold carburetor to intake manifold and lift carburetor off manifold.

9. Release PCV valve hose clamp attached to front of carburetor and remove hose from fitting.

10. Remove carburetor and stainless steel shim. Discard the carburetor gasket. The stainless steel shim may be used again if it is not warped, cracked or corroded and can be cleaned up.

NOTE: Carburetor Installation is covered in Note 86.

Carburetor Disassembly

NOTE: Place carburetor on proper holding fixture.

67. Air Horn Removal

1. On air conditioned cars, remove idle speed up device from carburetor by removing screw securing it to the air horn. Disengage pull rod from lever.

2. Remove clips from upper end of choke rod, disconnect choke rod from upper choke shaft lever and remove choke rod from bowl. Use a thin screwdriver to push the lower choke lever outward to help remove the rod.

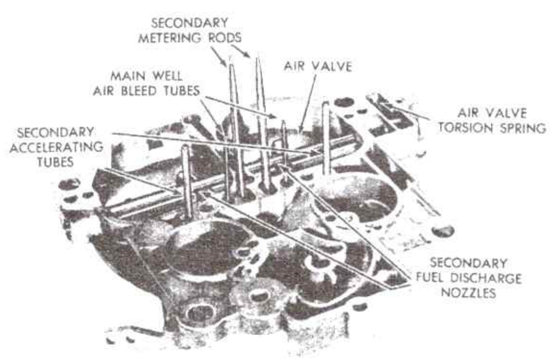


Fig. 6-86 Air Horn Assembled

3. Remove spring clip from upper end of pump rod, then disconnect pump rod from pump lever and lever on primary throttle shaft.

4. Remove clip from vacuum break rod and remove rod.

5. Remove secondary metering rod hanger screw and remove metering rods with hanger.

6. Remove nine air horn to bowl attaching screws, two attaching screws are located next to the primary venturi. (Two long screws, five short screws, two countersunk screws).

7. Remove air horn by lifting straight up. Air horn gasket should remain on bowl for removal later.

CAUTION: Care must be taken not to bend the small tubes protruding from air horn, Fig. 6-86. These are permanently pressed into casting.

68. Air Horn Disassembly

NOTE: Further disassembly of the air horn is not required for cleaning purposes. If part replacement is required, proceed as follows:

1. Remove choke valve attaching screws and then remove choke valve and shaft.

2. Remove pump lever roll pin then pump lever.

CAUTION: Air valves and air valve shaft, set screw and spring should not be removed.

NOTE: On A.I.R. carburetors, do not remove the triangular spring lock from the front vent tube. This is a tamper-proof spring installed to protect the screw adjustment under it.

69. Float Bowl Disassembly

1. Remove pump plunger from pump well, Fig. 6-87.

2. Remove air horn gasket from dowels on secondary side of bowl, then remove gasket from around power piston and primary metering rods.

3. Remove pump return spring from pump well.

4. Remove plastic filler over float valve.

5. Remove power piston and primary metering rods, using needle nosed pliers to pull straight up on metering rod hanger directly over power piston, Fig. 6-88. Remove power piston spring from well.

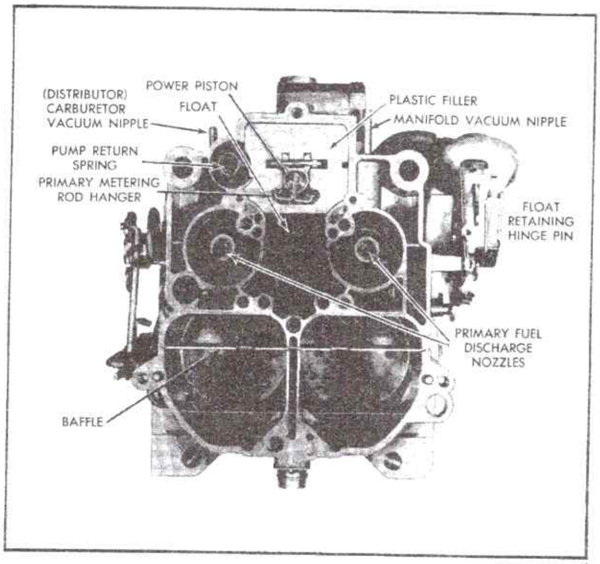


Fig. 6-87 Float Bowl Assembled

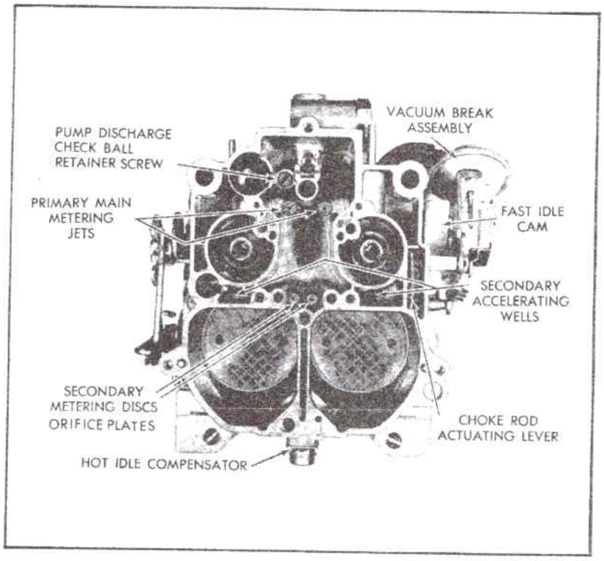


Fig. 6-89 Float Bowl Disassembled

6. Remove metering rods from power piston by disconnecting tension spring from top of each rod then rotating rod to remove from hanger. See inset of Metering Rod Assembly, Fig. 6-91.

7. Remove float assembly and float needle by pulling up on retaining hinge pin.

NOTE: Do not remove float needle seat unless it is damaged, in which case it and float needle must be replaced as an assembly.

8. Remove primary metering jets, Fig. 6-89. No attempt should be made to remove secondary metering plates.

9. Remove pump discharge check ball retainer screw and check ball.

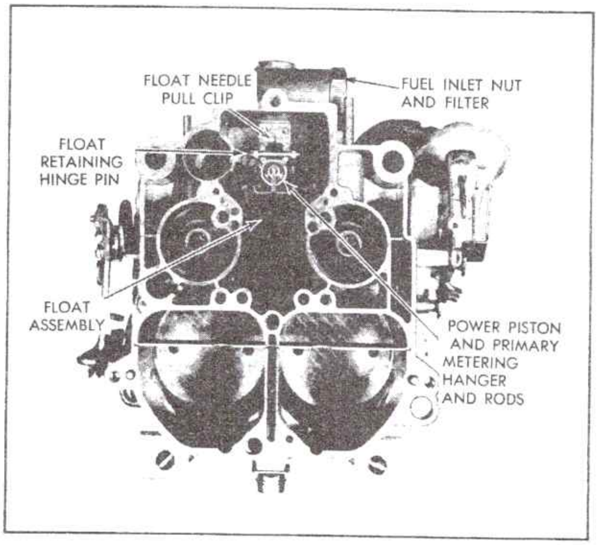


Fig. 6-88 Float Bowl Partially Assembled

10. Remove baffle from secondary side of bowl.

11. Remove vacuum hose from vacuum break assembly and from tube connection on bowl.

12. Remove retaining screw from choke assembly and remove assembly from float bowl.

NOTE: If further disassembly of choke lever mechanism is necessary, spread the retaining ears on bracket next to vacuum break assembly, then remove vacuum break assembly from lever.

13. On air conditioned cars, remove idle speed up lever.

14. Remove choke rod actuating lever from inside of float bowl well.

15. Remove two screws from hot idle compensator cover, then remove hot idle compensator and O-ring from float bowl.

16. Remove fuel inlet nut, gasket and screen.

17. Turn bowl over and remove throttle body by removing throttle body to bowl attaching screws using a Phillips screwdriver. See Fig. 6-90.

18. Remove throttle body to bowl insulator gasket.

70. Throttle Body Disassembly

1. Remove idle mixture screws and springs. Idle mixture screws on A.I.R. carburetors have

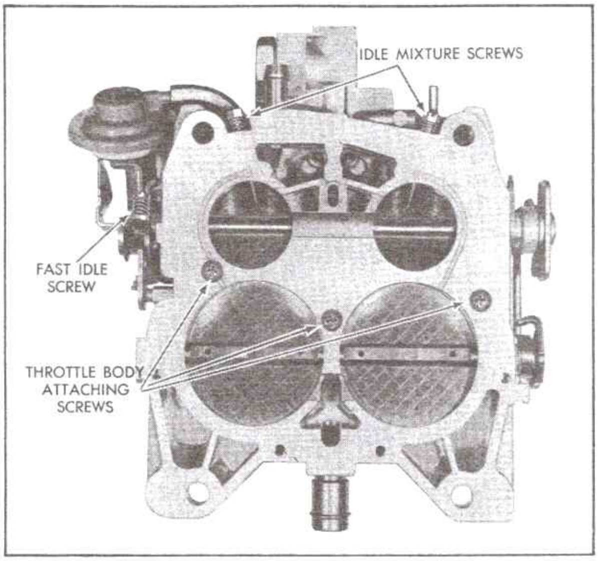


Fig. 6-90 Throttle Body

very long taper and should be handled carefully to avoid damage.

CAUTION: Extreme care must be taken to avoid damaging throttle valves.

NOTE: No further disassembly of the throttle body is required.

71. Carburetor Cleaning and Inspection

1. Thoroughly clean carburetor castings and metal parts, Fig. 6-91, in an approved cold immersion type carburetor cleaner.

CAUTION: Rubber parts, plastic parts, and pump plungers, should NOT be immersed in carburetor cleaner. However, the delrin cam on the air valve shaft will withstand normal cleaning in carburetor cleaner.

2. Blow out all passages in castings with compressed air. Do not pass drills through jets or passages.

3. Inspect idle mixture needles for damage.

4. Examine float needle and seat for wear. Replace if necessary with new float needle assembly.

5. Inspect upper and lower surfaces of carburetor castings for damage.

6. Inspect holes in levers for excessive wear or out of round conditions. If worn, levers should be replaced.

7. Examine fast idle cam for wear or damage.

8. Check air valve for binding conditions. If air valve is damaged, air horn assembly must be replaced.

9. Check all throttle levers and valves for binds or other damage.

Carburetor Assembly and Adjustment Procedures

72. Throttle Body Assembly

1. Install idle mixture needles and springs until lightly seated. Back out needles two turns as a preliminary idle adjustment.

73. Float Bowl Assembly

1. Install new throttle body to bowl insulator gasket onto bowl, being certain gasket is properly positioned over two locating dowels on bowl.

2. Install throttle body, making certain that it is properly located over dowels on float bowl; then install 3 throttle body to bowl screws and tighten evenly and securely, using a Phillips screwdriver.

Place carburetor on proper holding fixture.

3. Install fuel inlet screen, gasket (new), and inlet nut and tighten nut securely.

4. Install hot idle compensator O-ring seal in recess in bowl; then install hot idle compensator.

NOTE: If vacuum break diaphragm was removed from bracket, slide vacuum break diaphragm between retaining ears and bend ears down slightly to hold securely.

5. Install air conditioning idle speed up lever on cast pin located as shown in Fig. 6-112, if carburetor is so equipped.

6. Install fast idle cam on vacuum break assembly. Be sure fast idle cam actuating pin on intermediate choke shaft is located in cut-out area of fast idle cam.

7. Connect choke rod (plain end) to choke rod actuating lever, then holding choke rod, with grooved end pointing inward, position choke rod actuating lever in well of float bowl and install choke assembly, engaging shaft with hole in actuating lever. Install retaining screw and tighten securely. Remove choke rod from lever for installation later.

8. Install vacuum hose to tube connection on bowl and vacuum break assembly.

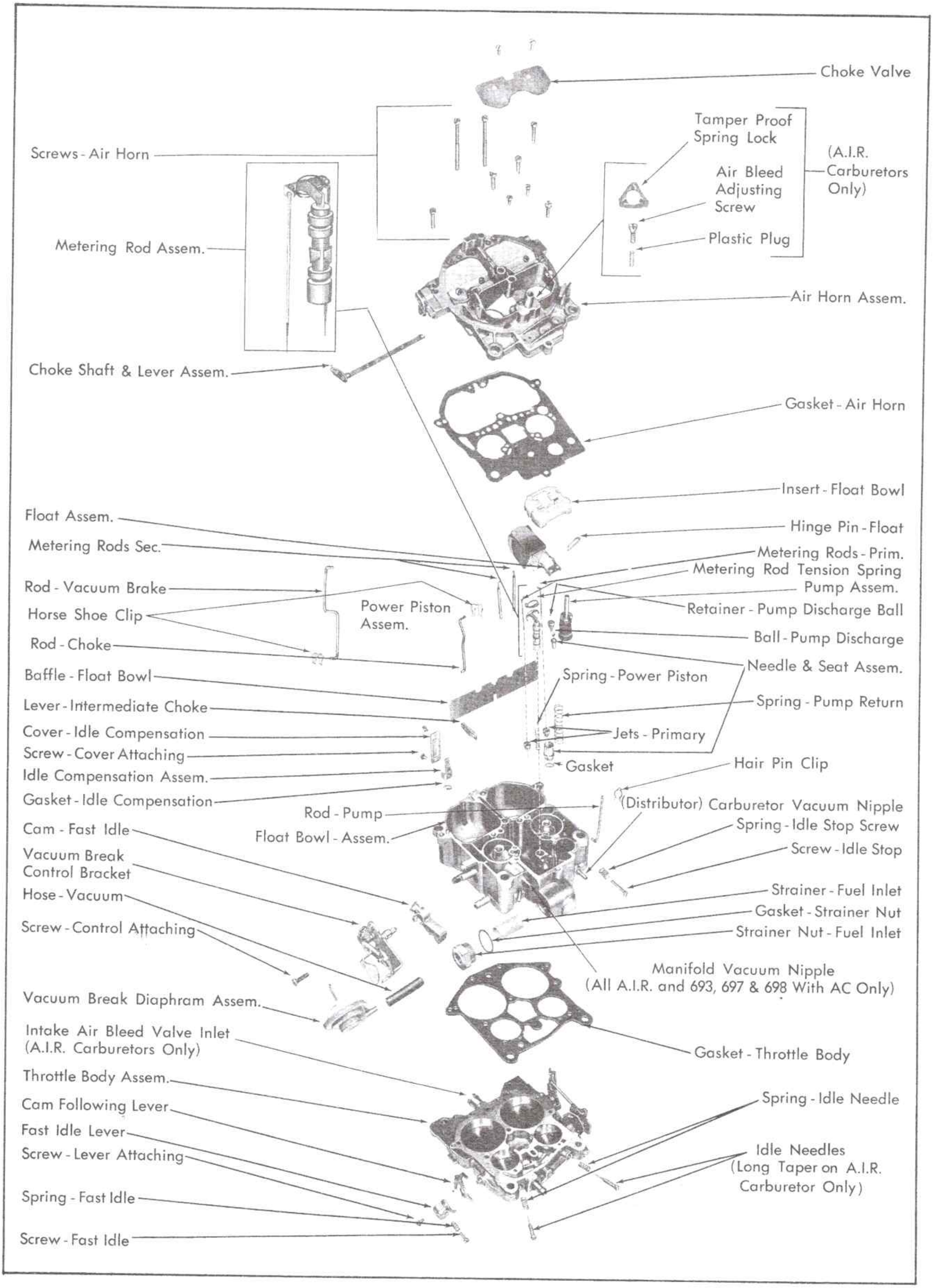


Fig. 6-91 4MV Quadrajet Exploded View

9. Install baffle in secondary side of bowl with notches toward top.

10. Install pump discharge check ball and retainer screw in passage next to pump well.

11. Install primary main metering jets.

12. Install float needle and pull clip.

13. Install float by sliding float lever under float needle pull clip from front to back. With float lever in pull clip, hold float assembly at toe and install retaining pin from pump well side.

14. Float Level Adjustment, Fig. 6-92.

a. With adjustable T-scale, measure from top of float bowl gasket surface (gasket removed) to top of float at toe (locate gaging point 3/16" back from toe). Scale dimension should be 7/32 inch or 0.210 inch.

NOTE: Make sure retaining pin is held firmly in place and tang of float is lightly seated on float needle.

b. Bend float up or down for proper adjustment.

15. Install power piston spring in power piston well. If primary main metering rods were removed from hanger re-install making sure that tension spring is connected to top of each metering rod. See Fig. 6-91. Install power piston assembly in well with metering rods properly positioned in metering jets. Press down firmly on power piston to make sure retainer is properly positioned in bore.

16. Install plastic filler over float needle, pressing downward until seated properly.

17. Install pump return spring in pump well.

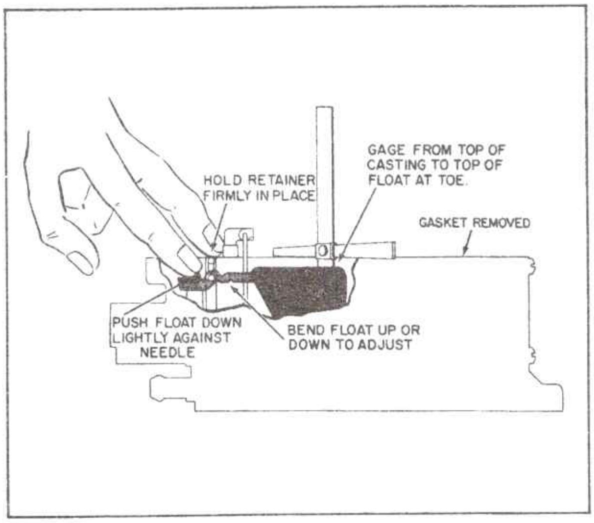


Fig. 6-92 Float Level Adjustment

18. Install air horn gasket around primary metering rods and piston. Position gasket over two dowels on secondary side of bowl.

19. Install pump plunger in pump well.

74. Air Horn Assembly

1. Install the following, if removed.

Pump lever with roll pin.

Choke shaft, choke valve and two attaching screws.

75. Air Horn to Bowl Installation

1. Place air horn assembly on bowl carefully, positioning vent tubes and accelerating well tubes through air horn gasket.

2. Install two long air horn screws, five short screws and two countersunk screws in primary venturi area. To prevent binding of choke valve or air valve due to distortion of air horn, all screws must be tightened evenly using the sequence shown in Fig. 6-93.

3. Connect pump rod in pump lever and retain with spring clip.

4. Connect choke rod in lower choke lever and retain in upper lever with spring clip.

5. Install vacuum break rod and clip.

6. Attach secondary metering rods to hanger and screw hanger with rods to cam lever located between the two air valves.

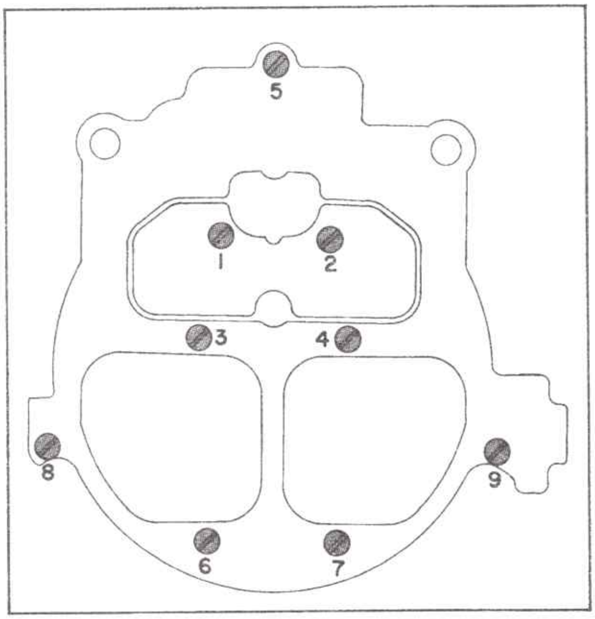


Fig. 6-93 Air Horn Screw Tightening Sequence

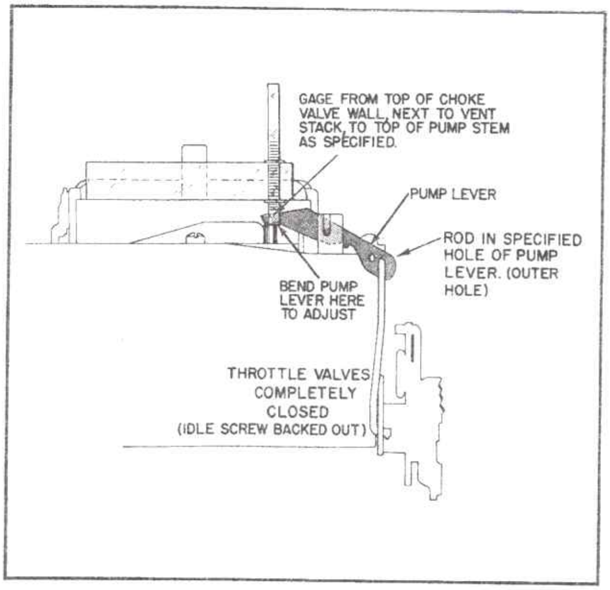


Fig. 6-94 Accelerator Pump Adjustment

76. Pump Rod Adjustment (Fig. 6-94)

1. With low speed idle screw backed out of contact, throttle valves completely closed and pump rod in outer hole of pump lever, measure from top of choke valve wall, next to vent stack, to top of pump stem with adjustable T-scale.

2. Dimension should be 11/32 inch. Bend pump lever at the pump stem end, Fig. 6-94, to adjust.

77. Fast Idle Adjustment (Fig. 6-95)

1. With primary throttle valves completely closed and cam follower over high step of fast idle cam, turn fast idle screw in 1 turn after screw makes contact on lever, Fig. 6-95.

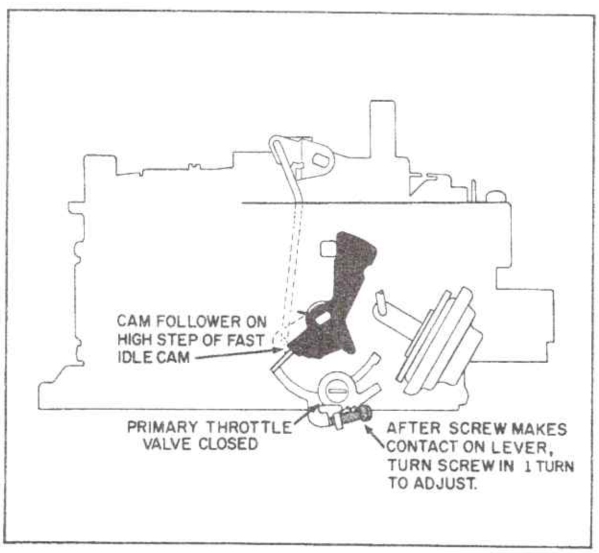


Fig. 6-95 Fast Idle Adjustment (Off Car)

78. Secondary Metering Rod Adjustment (Fig. 6-96)

1. To check secondary metering rod adjustment, measure from top of metering rod to top of air horn casting next to air cleaner stud hole, as shown in Fig. 6-96. The correct dimension is given in the following chart.

NOTE: Air valve must be closed when measurement is taken.

SECONDARY METERING ROD HEIGHT SPECIFICATION AS SHOWN IN FIG. 6-96	
All Except Eldorado 693 Series	.868 or 55/64 inch
Eldorado 693 Series . .	.858 or 55/64 inch

2. If adjustment is necessary, bend metering rod hanger with tool J-22514 at point shown in Fig. 6-96. Make sure both rods are adjusted to same dimension.

79. Choke Rod Adjustment (Fig. 6-100)

1. With fast idle adjustment made, and cam follower on second step of fast idle cam and against high step of fast idle cam, rotate the choke valve toward the closed position by pushing up on choke-coil-rod vacuum break lever.

2. With choke rod at bottom of choke lever slot, dimension between lower edge of choke valve and air horn should be .090 inch.

3. Bend choke rod, Fig. 6-100, to adjust.

80. Vacuum Break Adjustment (Fig. 6-97)

1. With vacuum break diaphragm stem against

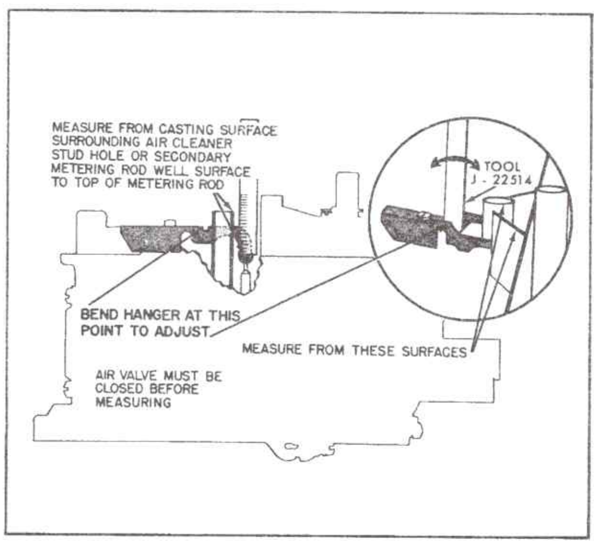


Fig. 6-96 Secondary Metering Rod Adjustment

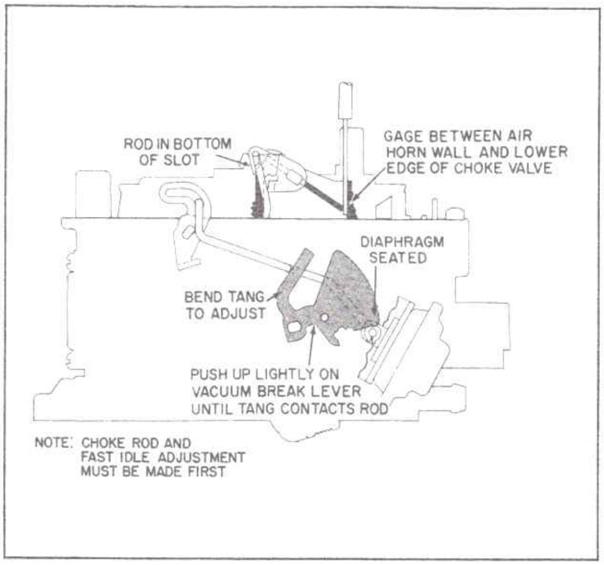


Fig. 6-97 Vacuum Break Adjustment

its seat and choke valve held toward closed position, the dimension between lower edge of choke valve and air horn, at choke lever end, should be .180 inch.

NOTE: The diaphragm may be seated by attaching a 3/16" I.D. rubber hose from the vacuum break diaphragm nipple, to any available external source supplying a vacuum of at least 6" hg.

2. Bend vacuum lever tang, Fig. 6-97, to adjust.

81. Air Valve Dashpot Adjustment (Fig. 6-98)

1. With air valve closed normally and vacuum break diaphragm seated, as described in the NOTE: in 6-79, there must be clearance of .030 inch between dash pot rod and end of slot in air valve lever.

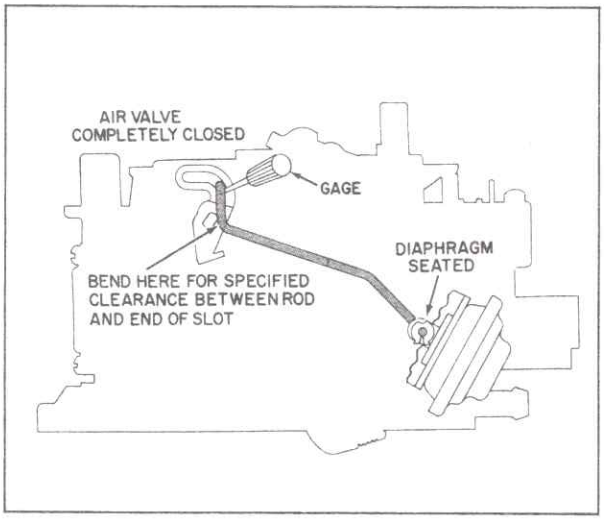


Fig. 6-98 Air Valve Dashpot Adjustment

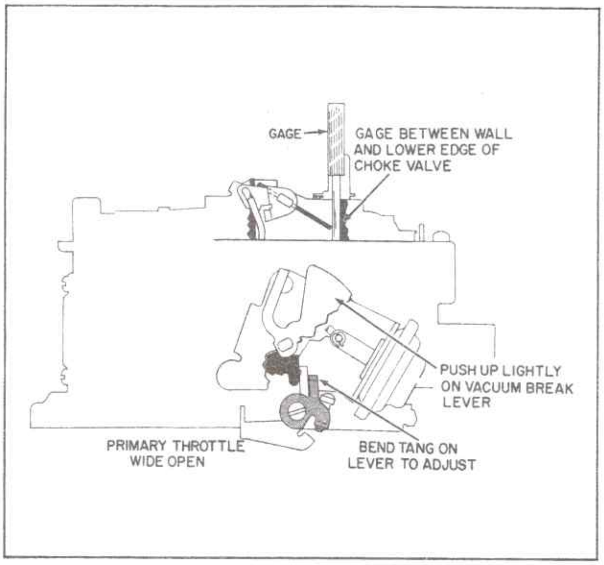


Fig. 6-99 Unloader Adjustment

2. Bend rod at air valve end, Fig. 6-98, to adjust.

82. Unloader Adjustment (Fig. 6-99)

1. With choke valve held toward closed position by lifting up on vacuum break lever, open primary throttle to wide open position.

2. With valves in this position, dimension between lower edge of choke valve and air horn wall should be .300 inch.

3. Bend tang on fast idle lever, Fig. 6-99, to adjust.

83. Air Valve Lockout Adjustment (Fig. 6-101)

A. Opening Clearance

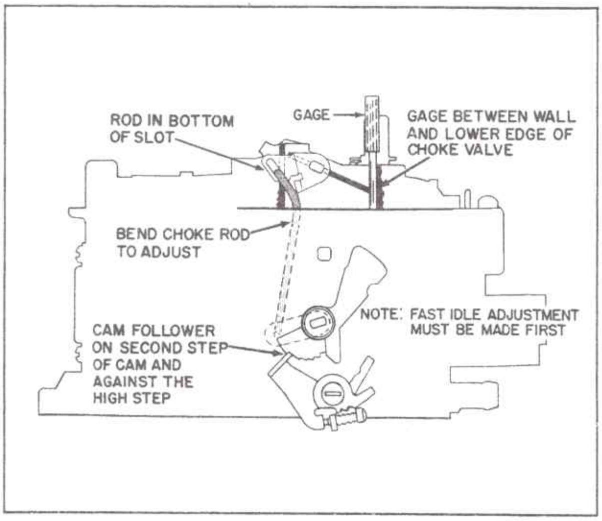


Fig. 6-100 Choke Rod Adjustment

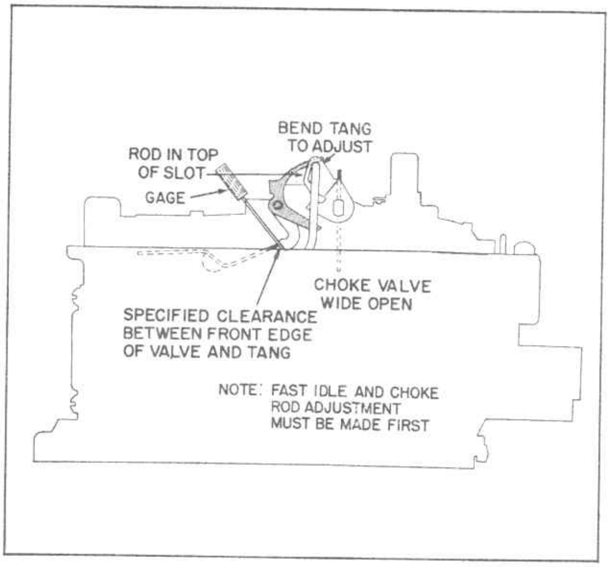


Fig. 6-101 Air Valve Lockout Adjustment

NOTE: Fast idle (off car) and choke rod adjustments must be made prior to this adjustment.

1. With choke valve wide open, apply sufficient force to choke-coil-rod (vacuum break) to move choke rod to top of slot in choke lever.

2. Move air valve slightly in direction of open valve.

3. Bend upper end of air valve lockout lever tang, Fig. 6-101, if necessary, to give an opening of .015 inch between lockout tang and front edge of air valve.

B. Lockout

1. With the opening clearance adjustments made, open choke valve to its wide open position by applying force to "up" side of choke valve.

2. Making sure choke rod is in bottom of slot in choke lever, air valve lockout tang should allow only 8° of air valve opening. During choke on condition (warm up) the air valve will only open 8° if the throttle is opened wide.

84. Secondary Throttle Opening Adjustment (Fig. 6-102)

1. Open primary throttle valves until actuating rod contacts tang on secondary throttle lever. With valves in this position, bottom of rod should be in center of secondary lever slot.

2. Bend tang on secondary throttle lever, Fig. 6-102, if necessary to adjust.

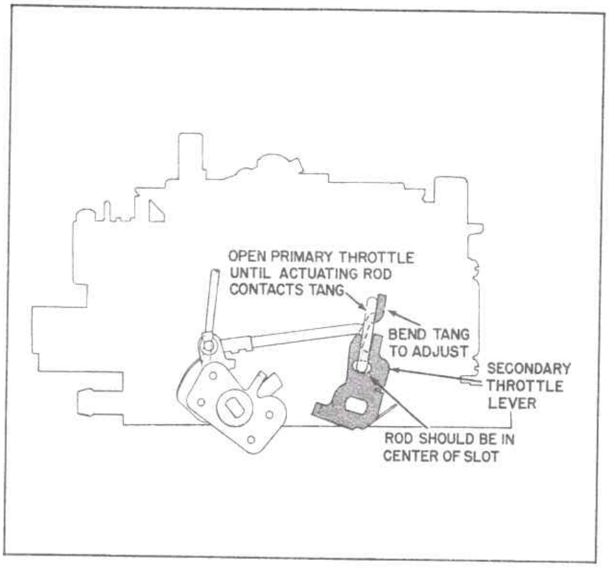


Fig. 6-102 Secondary Throttle Opening Adjustment

85. Air Valve Spring Wind-Up Adjustment (Fig. 6-103)

1. Loosen lockscrew (Allen screw) Fig. 6-103, and turn adjusting screw counterclockwise to remove all spring tension.

2. With air valve closed, turn adjusting screw clockwise 1/4 turn after torsion spring contacts pin on shaft. Holding adjusting screw in this position, tighten lockscrew.

86. Carburetor Installation

1. Clean surface of intake manifold, carburetor, and shim of any dirt, carbon or gasket material.

2. Place new carburetor gasket on top of manifold with side marked "top" facing up, Fig. 6-104.

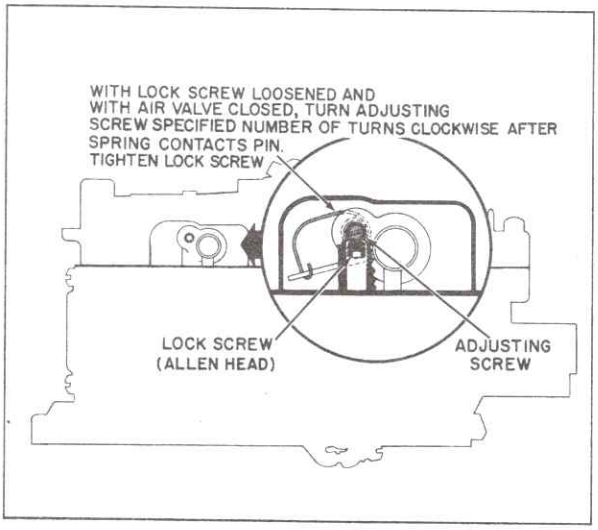


Fig. 6-103 Air Valve Spring Windup Adjustment

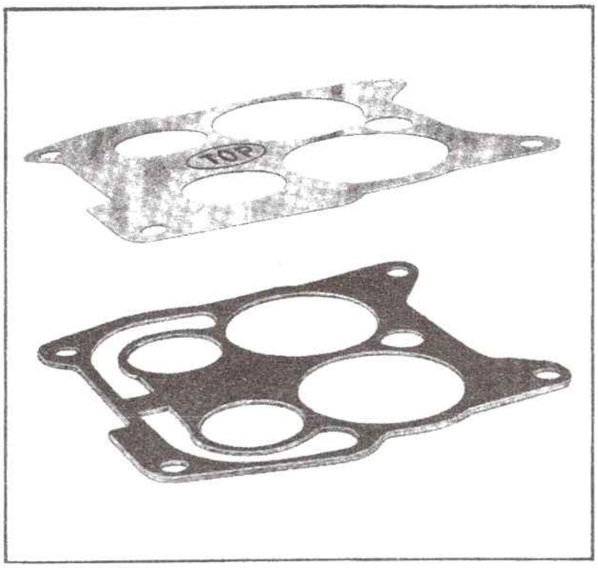


Fig. 6-104 Carburetor Gasket and Shim

3. Place cleaned stainless steel shim on top of gasket with side marked "top" facing up.

4. Tighten fuel inlet nut on front of carburetor securely.

5. Connect PCV valve hose to fitting on front of carburetor and secure with clamp.

6. Lower carburetor onto intake manifold.

7. Install two bolts and two screws to intake manifold. Tighten bolts and screws evenly. Tighten front screws to 8 foot-pounds and rear bolts to 14 foot-pounds.

NOTE: This torque must be as specified to allow accurate calibration of choke coil rod.

8. Connect the distributor vacuum line between the distributor and the 3/16" distributor vacuum nipple on the left side of the carburetor bowl near the idle adjusting screw.

NOTE: If car is an air conditioned Eldorado 693 series or a limousine (697 series) three vacuum lines are used in conjunction with a thermo vacuum switch (TVS). This switch is mounted on the left side of the radiator top tank. One vacuum line goes from the carburetor vacuum nipple on the carburetor (lower left front) to the nipple marked "C" on the TVS. The second vacuum line goes from the distributor to the nipple marked "D" on the TVS. The third vacuum line goes from the manifold vacuum nipple on the carburetor (upper right front near the fuel entrance) to the nipple marked "MT" on the TVS.

The vacuum hoses are color coded for easy routing and are all the same length in their respective series.

9. Install choke coil rod into vacuum break lever as the choke assembly is installed to the manifold. Tighten choke assembly to manifold with attaching bolt.

10. Connect carburetor fuel line at carburetor and fuel filter. Tighten all threaded fittings securely.

11. Connect throttle linkage and return spring(s).

12. On cars equipped with A.I.R. system, connect 5/8 inch inside diameter hose to fitting at lower rear of carburetor and 3/16 inch inside diameter hose to manifold vacuum fitting on lower front of carburetor near the fuel inlet.

NOTE: If the car has a thermo vacuum switch, then the vacuum is teed in at this nipple.

13. Install air cleaner mounting stud in carburetor, place air cleaner gasket in position and install air cleaner.

87. Choke-Coil Rod Adjustment (On Car) (Fig. 6-105)

1. Remove choke-coil assembly from manifold to disengage choke coil rod from vacuum break lever.

2. Reinstall choke coil assembly but do not install choke coil rod into hole in vacuum break lever.

3. With choke valve completely closed and vacuum break lever in maximum upward position, pull choke coil rod upward to end of travel against stop in choke coil housing. Upper end of rod should be positioned in gaging notch as shown in Fig. 6-105.

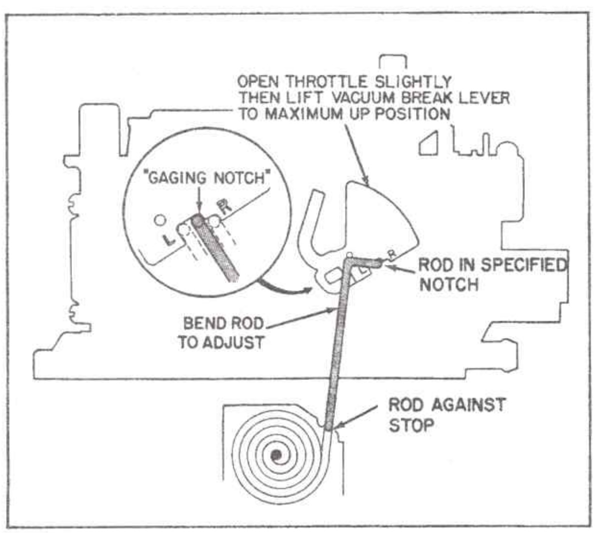


Fig. 6-105 Choke Coil Rod Adjustment

4. Bend choke-coil rod to adjust for position in proper gaging-notch.

5. Remove choke coil assembly from manifold. Reinstall by putting upper end of choke coil rod into hole in vacuum break lever and tighten coil assembly to manifold.

88. Low Speed Idle and Mixture Adjustment (On Car)

NOTE: If stainless steel shim is not installed, engine will not idle, see Note 86-3.

1. Disconnect parking brake vacuum hose at vacuum release cylinder.

NOTE: Hose must be disconnected at this location to include any calibrated leakage in balance of system.

2. Connect tachometer to engine and set parking brake securely. Place transmission selector lever in Neutral.

3. Remove air cleaner. Be sure that throttle dash pot is not holding throttle valves open.

4. For preliminary adjustment, turn idle speed adjusting screw in approximately 1-1/2 turns after screw contacts primary throttle lever. Start and warm engine to normal operating temperature. Be sure that choke is fully off and that carburetor is on slow idle with primary and secondary throttle valves closed.

5. Place transmission selector lever in either "DR" position.

6. Hot idle compensator must be closed when idle adjustments are made. This can be done by pressing finger or eraser end of pencil on air horn vent stack located just to left rear of secondary metering rod hanger.

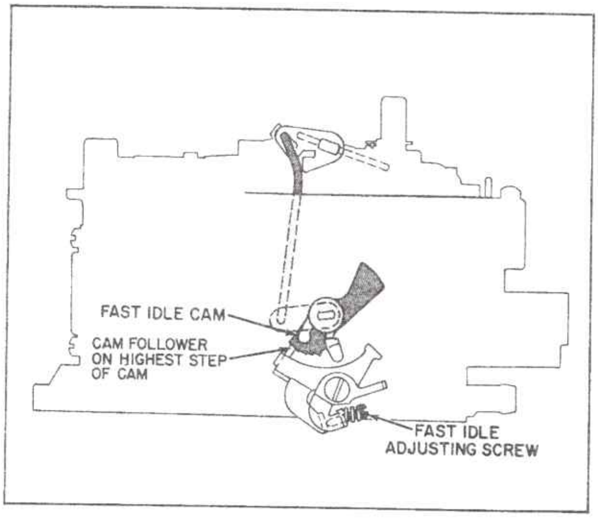


Fig. 6-106 Fast Idle Adjustment (On Car)

7. Set idle speed to not less than 480 rpm, and not more than 500 rpm, by adjusting low speed idle screw shown in Fig. 6-107.

NOTE: On cars equipped with A.I.R. system, set idle speed to 550 rpm; Air Conditioner must be off.

Air Conditioner should be operating on non A.I.R. cars so equipped. Place Automatic Climate Control lever in "auto" position. Disconnect and plug vacuum line from power servo located on firewall above engine.

8. Turn one idle mixture adjustment screw clockwise in order to obtain highest reading on tachometer.

Use Extension Hex-head Driver, J-22646, to facilitate adjustment of idle mixture screws on 693 cars with Air Conditioning.

Continue to turn screw until speed falls off 20 rpm. This point is lean idle speed fall off.

Turn screw counterclockwise until speed drops off 20 rpm. This point is rich idle speed fall off.

Now turn screw midway between rich and lean drop off for proper mixture setting.

NOTE: On cars equipped with A.I.R. system, reverse screw one and one-eighth turn from 20 rpm lean idle speed fall off.

9. Repeat step 8 with other idle mixture adjusting screw.

10. Reset idle rpm, as noted in step 7, and repeat steps 8 and 9, if speed is over 500 rpm (550 rpm on A.I.R. equipped cars).

Repeat procedure outlined in steps 7 through 10 until an idle speed of 480-500 rpm is reached on standard cars, and 550 rpm on cars equipped with A.I.R. system.

11. Install air cleaner and recheck idle. If idle speed is not within specifications, repeat procedure outlined in steps 7 through 10.

12. Shut off engine and remove tachometer.

13. Reconnect power servo vacuum line on air conditioned cars.

14. Connect parking brake vacuum cylinder line.

89. Fast Idle Adjustment (On Car) (Fig. 6-106)

NOTE: Preceding idle adjustments must be made first. Automatic Climate Control should be in "Off" position on cars so equipped.

1. Start engine and allow engine and transmission to reach operating temperature; choke should be fully open. Be sure parking brake is applied.

2. Shut off engine and remove air cleaner.

3. Open throttle slightly. Set fast idle cam follower on highest step of cam, Fig. 6-106.

4. Start engine. Choke valve will be open because engine is fully warmed up.

5. Observe idle speed and adjust fast idle screw, Fig. 6-106, to give 1700-1750 rpm with transmission in Neutral. Return engine to normal idle and install air cleaner.

90. Secondary Throttle Closing Adjustment (On Car) (Fig. 6-107)

1. Set curb idle screw to recommended rpm, as described in Note 88, making sure cam follower is not resting on fast idle cam.

2. There should be .020 clearance between actuating rod and front of slot in secondary throttle lever as shown in Fig. 6-107, when primary throttle middle lever is against tang of primary throttle outer lever.

3. If adjustment is correct, replace air cleaner.

4. If adjustment is necessary, remove transmission downshift switch by removing two screws from the dash pot bracket.

5. Disconnect throttle return spring(s) and throttle rod or cable at throttle adapter plate.

6. Remove two hex head screws holding throttle adapter plate to primary throttle outer lever, and remove throttle adapter plate.

7. Bend tang of primary throttle outer lever as necessary to adjust.

8. Attach throttle adapter plate to primary throttle outer lever.

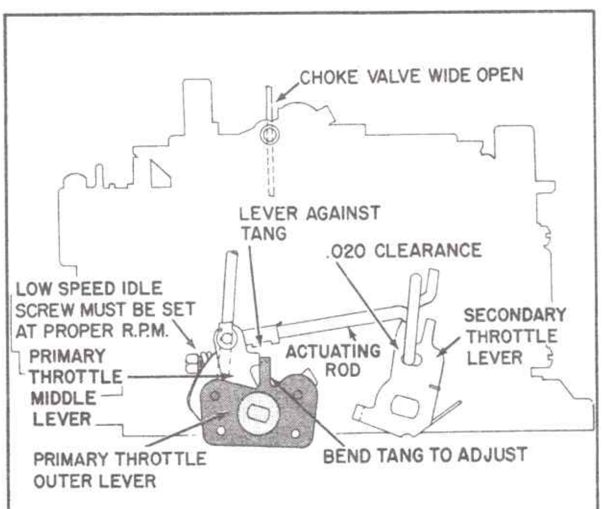


Fig. 6-107 Secondary Throttle Closing Adjustment

9. Connect throttle return spring(s) and throttle rod or cable at throttle adapter plate.

10. Install throttle and transmission downshift switch assembly and adjust as described in Note 6-96.

11. Install air cleaner.

91. Crankcase Filter Assemblies (Fig. 6-75) (For Closed System Ventilation)

a. Removal

NOTE: On Fleetwood Eldorado pull pipe to air cleaner from grommet on top of left strainer and remove strainer from grommet on left rocker arm cover. Remove P.C.V. valve elbow from top of right strainer and remove strainer from grommet on right rocker and cover. Carburetor air cleaner need not be removed.

1. Remove air cleaner wing nut and top cover.

2. Remove air cleaner element.

3. Remove hose from strainer.

4. Remove U-shaped clip retainer at neck of strainer and remove strainer.

5. If strainer(s) requires cleaning, use a solvent and reoil strainer(s) with engine oil.

b. Installation

NOTE: On Fleetwood Eldorado insert left strainer in grommet on left rocker arm cover and insert pipe from air cleaner into grommet on top of strainer. Insert right strainer in grommet on right rocker arm cover and insert P.C.V. valve elbow on top of strainer.

1. Install strainer in position in air cleaner, and secure with U-shaped retainer.

2. Install hose to strainer.

3. Install air cleaner element, air cleaner top cover and wing nut.

(For Open System Ventilation)

a. Removal

NOTE: On Fleetwood Eldorado remove left strainer from grommet on left rocker arm cover. Remove P.C.V. valve elbow from top of right strainer and remove strainer from grommet on right rocker arm cover.

1. Remove oil filler cap which is the crankcase filter on all non A.I.R. cars except Fleetwood Eldorado.

2. If strainer(s) requires cleaning, use a solvent and reoil strainer(s) with engine oil.

b. Installation

NOTE: On Fleetwood Eldorado insert left

strainer in grommet on left rocker arm cover. Insert right strainer in grommet on right rocker arm cover and insert P.C.V. valve elbow on top of strainer.

1. Install oil filler cap which is the crankcase filter on all non A.I.R. cars except Fleetwood Eldorado.

92. Positive Crankcase Ventilator Valve Replacement (Figs. 6-75 and 6-76)

a. Removal

1. Remove air cleaner.

2. Remove plastic spark plug wiring clip from its stud and position wiring out of the way.

3. Release hose clamp and hose from right rocker arm cover.

NOTE: On Fleetwood Eldorado remove large diameter end of P.C.V. valve from rubber elbow in oil separator (strainer) on the front of right rocker arm cover.

NOTE: On all Fleetwood Eldorados and other cars so equipped, a "Tee" connector for Automatic Level Control is installed between carburetor fitting and ventilator valve.

4. Release clamps securing P.C.V. valve to hose and remove valve.

b. Installation

1. To facilitate installation, apply a small amount of silicone on both ends of replacement valve.

2. Install new P.C.V. valve with smaller diameter end into rubber hose connected to carburetor. Secure with hose clamp.

3. Connect large diameter end of valve to ventilator hose and secure with large hose clamp.

NOTE: On Fleetwood Eldorado, position large diameter end of P.C.V. valve into elbow in oil separator (strainer) on the front of right rocker arm cover.

4. Install plastic spark plug wiring clip on its stud.

5. Install air cleaner.

CRANKCASE VENTILATOR VALVE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE
Slow, unstable idle, rolling, frequent stalling, breather backflow, and oily engine compartment.	Valve completely plugged, or stuck in backfire (engine off) position.
Engine operation OK, but breather backflow at heavy throttle, oily engine compartment.	Valve stuck in idle position.
Rough, fast idle. Engine stalls. No backflow.	Valve stuck in intermediate position.

NOTE: If the valve is inoperative, it should be replaced.

93. Fuel Filter Removal and Installation

a. Removal

1. On cars equipped with Air Conditioning, disconnect vapor return line from fuel filter.

2. While holding fuel filter in position, loosen nuts and disengage fuel lines.

3. While holding fuel filter, remove one bolt and lockwasher holding fuel filter to oil filler housing bracket and remove filter.

b. Installation

1. Position inlet and outlet lines in fuel filter and start bolt with lockwasher that attaches fuel filter to oil filler housing bracket.

2. Tighten fuel filter outlet and inlet line nuts while holding filter steady.

3. Tighten bolt securing fuel filter to oil filler housing bracket while holding filter steady.

4. On cars equipped with Air Conditioning, connect vapor return line to fuel filter.

94. Throttle Rod Adjustment (All Cars Except Fleetwood Eldorado)

1. Remove air cleaner.

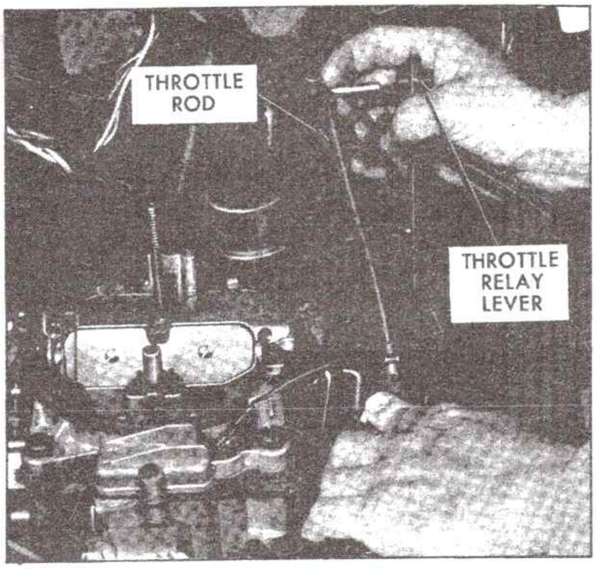


Fig. 6-108 Throttle Rod Adjustment except 693

2. Check linkage for free movement in all positions, and check to see that return spring fully closes the throttle.

3. Remove cotter pin that holds end of throttle rod in relay lever, and remove washers and end of rod from relay lever.

4. On cars equipped with Cruise Control, detach Cruise Control linkage at Cruise Control power unit end.

5. While a helper presses accelerator pedal against floor mat, hold carburetor throttle lever in full throttle (wide open) position. Make sure choke valve is wide open.

6. Loosen lock nut and throttle rod end in either direction as necessary to allow free entry into bushing on relay lever, Fig. 6-108.

7. With accelerator pedal released, reinstall washer on throttle rod and install rod into bushing in relay lever.

8. Install other washer and then install cotter pin. With accelerator pedal pressed again to floor mat, recheck throttle for wide open position.

9. On cars equipped with Cruise Control, install Cruise Control linkage. If adjustment on throttle rod was changed, it will be necessary to adjust Cruise Control linkage as outlined in Section 15, Note 19.

95. Throttle Rod Adjustment (693 Fleetwood Eldorado)

1. Remove air cleaner.

2. Check cable linkage for free movement in all positions, and check to see that return spring fully closes throttle.

3. Disconnect cable rod retaining spring at throttle adapter plate and remove cable rod from adapter plate.

4. On cars equipped with Cruise Control, detach Cruise Control linkage at Cruise Control power unit end.

5. While a helper presses accelerator pedal against floor mat, hold carburetor throttle lever in full throttle (wide open) position. Make sure choke valve is wide open.

6. If cable rod fitting does not line up exactly with its connecting hole on throttle adapter plate, loosen two cap screws at cable mounting plate on left rear of carburetor, and position cable backward or forward to allow exact alignment into throttle adapter plate hole, Fig. 6-109.

7. Tighten cable mounting screws on mounting plate.

8. With accelerator again pressed to floor mat, recheck throttle for wide open position.

9. On cars equipped with Cruise Control, install Cruise Control linkage. If adjustment on throttle cable linkage was changed, it will be necessary to adjust Cruise Control linkage as outlined in Section 15, Note 19.

10. Replace air cleaner.

96. Transmission Downshift Switch Adjustment

1. Remove carburetor air cleaner.

2. Make certain that carburetor is adjusted to

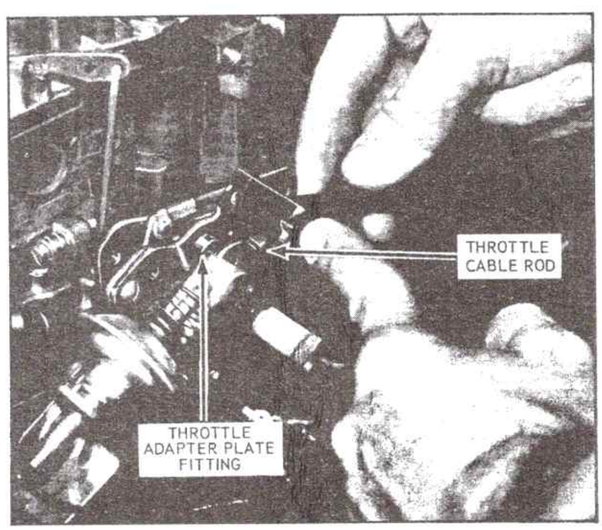


Fig. 6-109 693 Throttle Rod Adjustment

specification and that throttle linkage is at low speed idle setting.

3. If transmission downshift switch is properly adjusted, Fig. 6-110, a #31 wire gage size drill or equivalent can be inserted through the calibrating hole below lower wire terminal extending through to carburetor side of switch.

NOTE: With this adjustment the stator should break contact at 6° ± 1 1/2° from closed hot idle throttle and make contact at 40° throttle. The downshift should make contact above 60° throttle.

4. If adjustment is necessary, loosen the two 7/16" switch mounting screws and position switch for proper alignment to perform step 3.

5. With switch positioned, tighten mounting screws and remove 1/8" drillrod from calibrating hole through switch.

6. Repeat step 3. If necessary, repeat step 4.

7. Install air cleaner.

97. Transmission Down Shift Switch Removal and Installation

a. Removal

1. Remove air cleaner.

2. Disconnect three wire connectors.

3. Remove two cap screws from dash pot mounting bracket.

4. Remove downshift switch.

NOTE: Transmission downshift switch can be removed with throttle dash pot as an assembly by removing two screws and washers at base of bracket under ignition coil mounts.

b. Installation

NOTE: If downshift switch was removed along with throttle dash pot mounting bracket as an assembly, install bracket after positioning actuating shaft as described in step 1 below and secure bracket under coil mount with two screws and washers.

1. Holding switch in approximate in car mounting position, turn switch actuating shaft counterclockwise until it stops. Insert shaft into hole on throttle adapter plate.

2. Insert two mounting screws through switch mounting to throttle dash pot mounting bracket and lightly tighten.

3. Adjust switch as described in Note 6-96.

4. Connect three wires to terminal on switch.

5. Replace air cleaner.

98. Throttle Dash Pot Adjustment

NOTE: To adjust the dash pot, an adjusting tool should be made out of #22 (0.030 inch) gage stock according to the dimensions shown in Fig. 6-113. The critical dimensions of the tool are 1-7/32" and 0.030". Idle speed, Note 6-88 must be made prior to this adjustment.

1. Remove carburetor air cleaner.

2. Back off locknut locking dash pot in bracket.

3. Install dash pot adjusting tool on dash pot

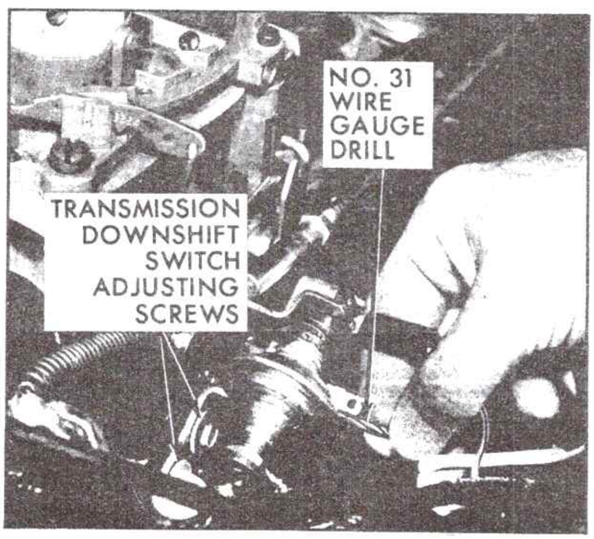


Fig. 6-110 Transmission Downshift Switch Adjustment

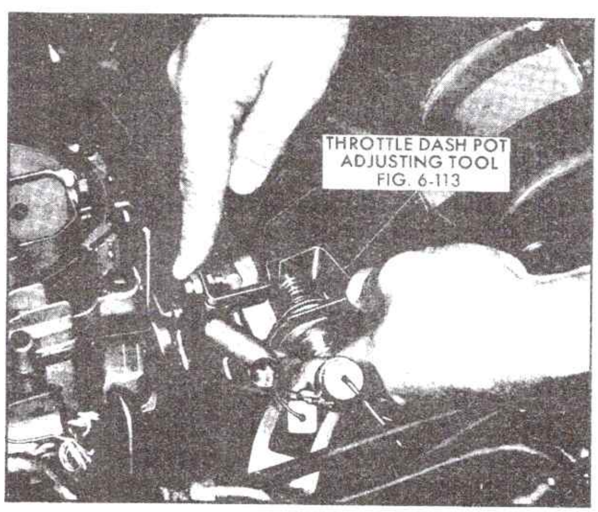


Fig. 6-111 Throttle Dash Pot Adjustment

with 3/8" wide prongs fitting over end nearest bracket, Fig. 6-111.

4. With throttle lever adapter plate in idle position (throttle valves closed), adjust dash pot fore or aft until dash pot adjusting tool just touches throttle lever adapter plate cam.

5. Tighten locknut to lock dash pot to bracket.

6. Remove dash pot adjusting tool.

7. Install air cleaner.

NOTE: Adjustment can also be made by using an 0.030 feeler gage between dashpot stem and throttle adapter plate with throttle at curb idle and dashpot stem pushed completely into dashpot. Adjust dashpot to maintain this clearance.

8. Start and warm up engine to operating temperature and make certain fast idle screw is released from fast idle cam.

9. Apply foot brake firmly with left foot and place selector lever in Drive. On Air Conditioned cars, make sure the system is in operation. Depress accelerator pedal and release rapidly.

NOTE: Do not depress accelerator pedal repeatedly, or transmission may become overheated.

10. If engine stalls, clearance is too great. Place selector lever in Neutral, loosen locknut on dash pot and turn dash pot counterclockwise two flats. Tighten locknut and repeat step 9.

11. Road test car.

99. Throttle Dash Pot Assembly Removal and Installation

a. Removal

1. Remove air cleaner for greater accessibility.

2. Loosen locknut securing dash pot shaft to bracket, Fig. 6-111, and unscrew dash pot from weld nut on bracket.

NOTE: Throttle dash pot assembly can also be removed along with its mounting bracket by removing two screws and washers at base of bracket under ignition coil mounts.

3. Remove dash pot assembly from engine.

b. Installation

1. Install dash pot shaft with locknut into weld nut on mounting bracket, and secure with locknut, Fig. 6-111.

NOTE: If throttle dash pot was removed along with its mounting bracket, install dash pot and mounting bracket by positioning bracket under coil mounts and securing with two screws and washers.

2. Install air cleaner.

3. Adjust dash pot as outlined in Note 6-98. If bracket was removed, check transmission downshift switch adjustment also.

100. Air-Condition Idle Speed Up Control Adjustment (On Car)

1. With shift lever in PARK position, start engine and allow it to warm up.

2. Remove carburetor air cleaner.

3. Remove vacuum hose from Automatic Climate Control power servo vacuum actuator and plug hose.

4. Set Automatic Climate Control selector lever in AUTO position.

5. Adjust nuts on idle speed-up control rod, Fig. 6-112, to maintain an idle speed of 900-950 RPM. Secure adjuster nuts.

6. Shut off engine, reconnect vacuum hose to power servo and install carburetor air cleaner.

101. Fuel Pump Tests

1. To check fuel pump capacity, remove fuel filter as described in Note 6-93a. Connect a hose at filter inlet pipe so that fuel may be discharged into a container.

2. Raise front end of car.

3. Disconnect flexible fuel line to fuel pump from metal supply line at right side of engine.

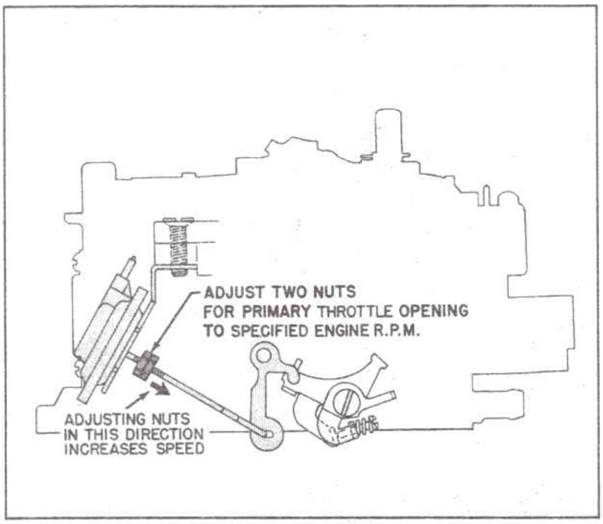


Fig. 6-112 Air Conditioning Idle Speed Up Adjustment

Plug supply line to keep gasoline from draining out of tank.

4. Insert disconnected end of flexible line into a quart container of kerosene or solvent. Be sure end of hose does not rest against bottom of container and container is at same level as fuel pump.

5. Connect a jumper wire from the coil primary negative terminal, on the distributor side, to a good ground, so that engine will not start.

6. Crank engine to prime pump until approximately 1/2 pint has been pumped before checking output. Seventeen strokes should fill a pint container. If liquid is delivered as specified, pump delivery is normal. If pump delivery is below normal, check for the following.

a. Loose fitting or connection at inlet side of pump. Use new hose clamp, or replace pump if fitting is damaged.

b. Flexible inlet line pinched, broken, porous, or obstructed. Replace flexible line.

c. Check camshaft eccentric for wear visually by using mirror and flashlight through mounting flange; inspect fuel pump arm for wear.

7. If pump does not operate properly after these corrections have been made, replace pump.

NOTE: By following the procedure given below, the displacement capacity of the pump can be increased by as much as 5 cc per stroke.

8. When installing pump, crank engine until camshaft eccentric is at its low point of contact with fuel pump arm. With mounting screws loose, lift up on pump. At the same time, tighten screws to 15 foot-pounds.

9. To check for pump pressure, remove hose from filter inlet pipe, install pressure gage. At cranking speed, fuel pump pressure should be 5-1/4 to 6-1/2 pounds per square inch.

10. If pressure is out of specified range, replace pump.

NOTE: Pump will not hold pressure because 0.012 bleed valves are in both outlet and inlet valves.

11. Remove pressure gage, holding a cloth around the connections to absorb any gasoline that might spray out as the gage is detached. Install fuel filter as outlined in Note 6-93b.

12. Remove plug from steel fuel supply line and connect rubber line to steel line.

13. Remove jumper wire at coil negative terminal.

14. Lower car.

102. Fuel Pump Removal and Installation

a. Removal

NOTE: On cars equipped with A.I.R. system, except the Fleetwood Eldorado, it is necessary to remove air pump as described in Note b-138a, and remove bolt that holds strut to pump front mounting bracket. Swing front of strut out of way to gain access to fuel pump.

1. Connect a jumper wire from coil primary negative terminal, on distributor side, to a good ground, so that engine will not start.

2. Loosen two cap screws holding fuel pump to engine front cover.

3. Crank engine until camshaft eccentric is at its low point of contact with fuel pump arm, and pump has minimum pressure on mounting screws.

4. Disconnect fuel line between fuel filter and pump. Remove line. Use a cloth to absorb gasoline.

5. Release hose clamp securing rubber hose to fuel pump inlet and plug rubber hose from tank to prevent fuel drainage. On Eldorado 693 equipped with A.I.R. system, remove corded rubber baffle from front crossmember and remove rubber hose from connector located on crossmember instead of at fuel pump inlet. Plug end of hose from tank to prevent fuel drainage.

6. Remove two cap screws that hold fuel pump to engine front cover and remove pump. Discard gasket. On Eldorado 693 equipped with A.I.R. system, remove power steering pump belt to facilitate fuel pump removal.

b. Installation

1. On Fleetwood Eldorado equipped with A.I.R. system, attach rubber fuel inlet hose to connector with clamp behind front crossmember. See that tangs on clamp face upward.

2. Position gasket on pump and install pump on cover. Loosely install screws. Lift pump and tighten screws to 15 foot-pounds.

3. On all cars except Fleetwood Eldorado equipped with A.I.R. system, remove plug and connect rubber inlet fuel hose to pump, securing with hose clamp.

4. Install fuel line between fuel pump and filter.

5. On Fleetwood Eldorado equipped with A.I.R. system, replace and adjust power steering pump belt and adjust to 55-70 lbs. tension.

NOTE: On cars equipped with A.I.R. system, except the Fleetwood Eldorado, replace air pump as described in Note 6-138b.

QUADRAJET 4 MV DIAGNOSIS CHART

IMPORTANT

Before attempting carburetor diagnosis as outlined below, all other engine systems must be operating properly. Diagnosis of these systems (electrical, exhaust, mechanical, and in the case of fuel economy, odometer accuracy) is found in this Service Manual. The numbers 1, 2 and 3, under the CONDITION are the order of probability. The * indicates additional possibilities.

CONDITION											CHECK POINTS
HARD STARTING—COLD	HARD STARTING—HOT	COLD OPERATION	HESITATION	ACCELERATION FLATNESS	STALLING	ROUGH IDLE	ECONOMY	FLOODING	SURGE	LACK OF HIGH SPEED PERFORMANCE	
1	1						1				Driver Habits (Instruct Owner on Proper Procedures)
*		4					*				Check Choke Rod Adjustment
*		5					*				Check Vacuum Break Adjustment
*		6									Check Thermostatic Choke Rod Adjustment
*		*									Check Choke Unloader Adjustment
2		1					2				Check Choke Valve & Linkage, Binding or Stuck
			*	2						3	Air Valve Binding, Stuck, Wrong Spring Tension Adj.
			*	1						*	Check Air Valve Lock-Out Adjustment
			*	4						*	Air Valve Dashpot Binding on Sticking
			*	*						*	Secondary Metering Rods Bent, Wrong Part
			*								Secondary Baffle Plates Missing
			*	*						*	Secondary Main Discharge Nozzles Plugged or Dirty
				3			3		3	*	Power Piston Stuck or Binding
							*		*		No Vacuum to Power Piston
							4		*	*	Primary Metering Rods Altered, Bent or Wrong Part
*		7	1								Check Accelerator Pump System & Adjustment
*	*	*	*		4						Throttle Return Check Misadjusted or Leaking Vacuum
3	*			*	*					*	Fuel Pump Pressure or Volume Not to Specification
					1	1					Check Slow Idle Adjustment
*		2									Check Fast Idle Adjustment
		*			*	*	*	*	1	*	Primary Metering Jets Plugged, Loose, Wrong Part
*	*	*		*		*	*	2	4	*	Float Sticking or Level Misadjusted
*	*	*				*	*	3	*		Float Bowl Porous, Cracked, Etc.
*		*		*	*	*				*	Throttle Body to Float Bowl Screws Loose
*	3	*			*		*	1	2		Float Needle Leaking
	*	*	*		*	4		*			Idle Compensator Not Opening or Closing
					*	3					Idle Passages Plugged or Dirty
				5	*	*	*		*		Crankcase Vent Valve Plugged
*		*		*	*				*	*	Fuel Filter in Gas Tank Plugged
				*	*			*	*	*	Fuel Filter in Carburetor Plugged or Dirty
	*	*		*	*	*	6	*	*		Air Cleaner Element Plugged
*		*		*	*				*	*	Hole in Fuel Pump Suction Line
		*	3	*	2	2	*			2	Check Auto. Trans. Throttle Switch Adjustment
		3	2				5				Heat Riser Valve Stuck Open or Closed
*	*	*	*		3	*			*		Secondary Throttle Valves Sticking Open
										1	Check for Full Throttle Position at Carburetor

QUADRAJET CARBURETOR SPECIFICATIONS
MODEL 4MV

Throttle Bore		Choke Rod Adjustment	.090"
Primary	1-3/8"	Vacuum Break Adjustment	.180"
Secondary	2-1/4"	Pump Rod Adjustment	.296"
Main Venturi		Outer hole capacity 7.0 to 10.0 cc per 10 strokes	
Primary	1.093"	Air Valve Adjustment	.884"
Secondary	.625"	Unloader Adjustment	.312"
Tertiary	.281"		
Float Level Adjustment	(7/32") .210"		

METERING SPECIFICATIONS
For Series
680, 681, 682, 683, 697
and 698 without A.I.R.

Primary Side	INCH
Idle Tubes	.036
Channel Restrictions	.045
Auxiliary Well Bleeds	.030
Side Well Bleeds	.050
Top Well Bleeds	.050
Side Idle Bleeds	.047
Metering Rods Economy End	.040
Metering Rods Power End	.026
Metering Jets	.070
Idle Mixture Screws	1 to 2 turns
Secondary Side	
Secondary Well Tubes	.036
Secondary Rods Identification	AK
Secondary Rod Wide Open Throttle Step	0.057
Accelerating Well Feed Holes	.040
Accelerating Well Discharge Holes	.035

METERING SPECIFICATIONS
For Series
680, 681, 682, 683, 697
and 698 with A.I.R.

Primary Side	INCH
Idle Tubes	.036
Channel Restrictions	.050
Auxiliary Well Bleeds	.030
Side Well Bleeds	.050
Top Well Bleeds	.050
Side Idle Bleeds	.047
Metering Rods Economy End	.041
Metering Rods Power End	.026
Metering Jets	.070
Idle Mixture Screws	3 to 4 turns
Secondary Side	
Secondary Well Tubes	.036
Secondary Rods Identification	AK
Secondary Rod Wide Open Throttle Step	0.057
Accelerating Well Feed Holes	.040
Accelerating Well Discharge Holes	.035

METERING SPECIFICATIONS
For Series
693 without A.I.R.

Primary Side	INCH
Idle Tubes	.036
Channel Restrictions	.046
Auxiliary Well Bleeds	.030
Side Well Bleeds	.050
Top Well Bleeds	.050
Side Idle Bleeds	.047
Metering Rods Economy End	.037
Metering Rods Power End	.026
Metering Jets	.067
Idle Mixture Screws	1 to 2 turns
Secondary Side	
Secondary Well Tubes	.028
Secondary Rods Identification	BD
Secondary Rod Wide Open Throttle Step	0.058
Accelerating Well Feed Holes	.040
Accelerating Well Discharge Holes	.035

METERING SPECIFICATIONS
For Series
693 with A.I.R.

Primary Side	INCH
Idle Tubes	.036
Channel Restrictions	.052
Auxiliary Well Bleeds	.030
Side Well Bleeds	.050
Top Well Bleeds	.050
Side Idle Bleeds	.047
Metering Rods Economy End	.039
Metering Rods Power End	.026
Metering Jets	.067
Idle Mixture Screws	3 to 4 turns
Secondary Side	
Secondary Well Tubes	.028
Secondary Rods Identification	BD
Secondary Rod Wide Open Throttle Step	0.058
Accelerating Well Feed Holes	.040
Accelerating Well Discharge Holes	.035

FUEL PUMP SPECIFICATIONS

NOTE: Testing to be done with entire car at room temperature.

Fuel pressure at idle speed . . . . 5-1/4 to 6-1/2 psi

Fuel pump discharge per stroke at cranking speed . . . . 28 cc. Minimum

Fuel pump discharge in 17 strokes at cranking speed. . . . . 1 pint Minimum

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Torque
280-M	Carburetor to Intake Manifold Bolt (Rear)	5/16-18	14 ft. lbs.
280-M	Carburetor to Intake Manifold Screw (Front)	5/16-18	8 ft. lbs.
260-M	Fuel Pump to Engine Front Cover Screw	3/8-16	15 ft. lbs.

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.

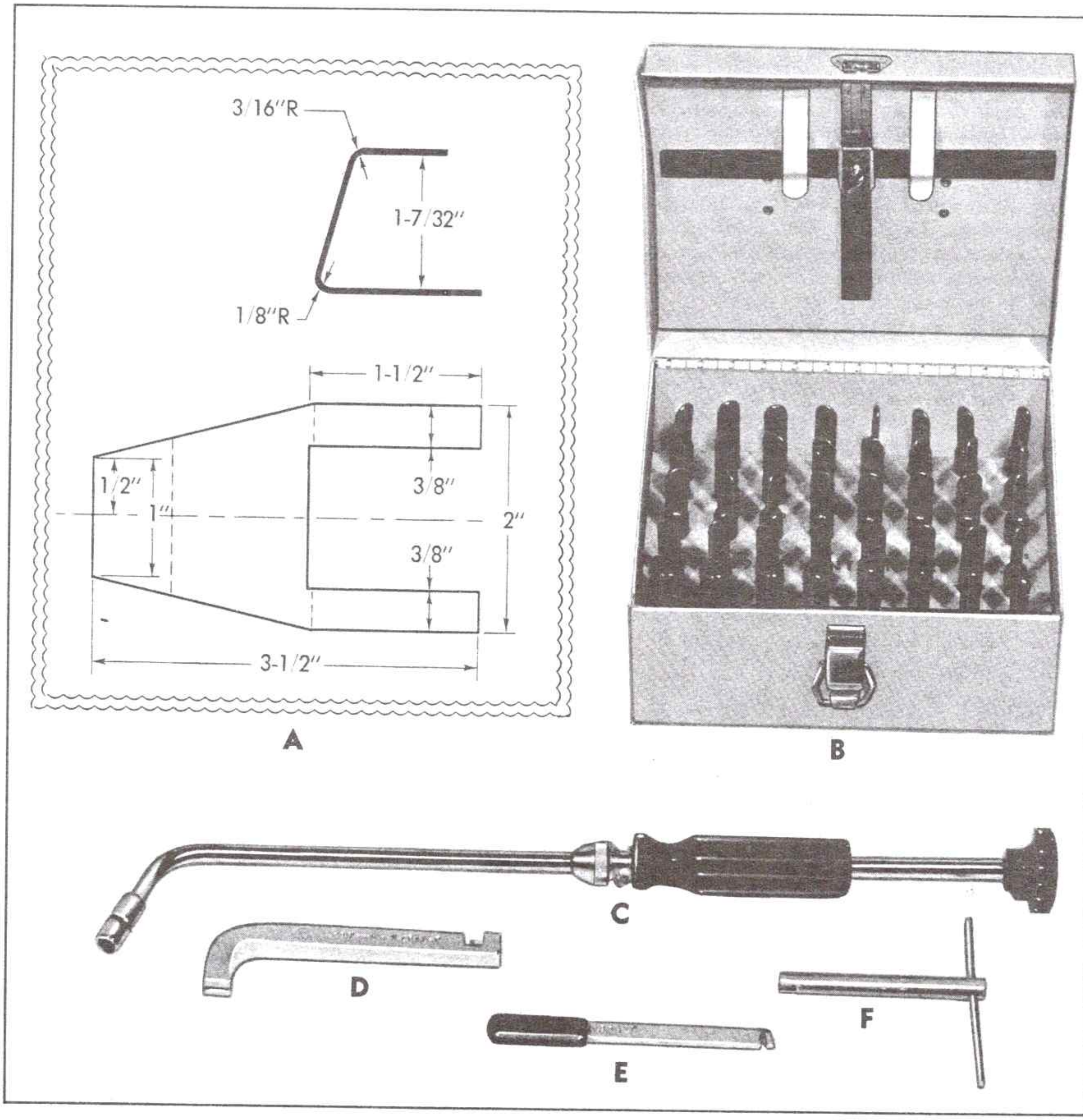


Fig. 6-113 Special Tool Board

Key	Tool No.	Name
A		Throttle Dashpot Adj. Tool
B	J-9789-01	Universal Gage Set
C	J-22646	1/4" Hex-head Extension Driver
D	J-1137	Bending Tool
E	J-22514	Bending Tool
F	J-5197	Bending Tool

GENERAL DESCRIPTION

The engine in all 1967 series Cadillac cars is of the overhead valve 90°, V-eight design. The cylinder bore diameter is 4.130 inches and the piston stroke is 4.000 inches, providing a piston displacement of 429 cubic inches. The engine has a compression ratio of 10.5 to 1, and develops 340 horsepower at 4600 rpm. Peak torque of 480 foot-pounds is developed at 3000 rpm. A three-quarter view of the engine and transmission, used in all cars except the 693 series Fleetwood Eldorado, is shown in Fig. 6-114.

Design Features

The cast iron cylinder block is designed with two 90° cylinder banks having four cylinder bores in each bank.

Cylinder numbering is by cylinder arrangement. The left front cylinder is number one, and the right front is number two. Cylinders on the left bank have odd numbers (1, 3, 5, and 7) and those on the right bank have even numbers (2, 4, 6, and 8).

The firing order is 1-8-7-2-6-5-4-3.

The die cast aluminum engine front cover is designed with mounting provisions for the oil pump, oil filter, oil filler tube, fuel pump, distributor, and water pump, to provide a compact and accessible accessory arrangement.

The crankshaft is designed to provide a four inch stroke. The cast crankshaft with three inch diameter journals is supported by five shell-type main bearings of steel-backed aluminum and steel-backed babbitt. End thrust of the crankshaft is taken by the center main bearing. Six counterweights are integral with the crankshaft. A harmonic balancer is pressed on the front end of the crankshaft.

Connecting rods for pistons of opposite cylinders are carried side by side on the same crankpin. Shell type connecting rod bearings are of steel-backed aluminum.

The cast aluminum pistons use two compression rings and one oil ring. To provide a non-scuffing surface when the engine is new, the pistons are tin-plated. A trough on the top of each piston increases the turbulence of the fuel mixture in the combustion chamber for more complete burning.

Piston pins are press-fitted into the connecting rods. Broached grooves in each piston pin bore

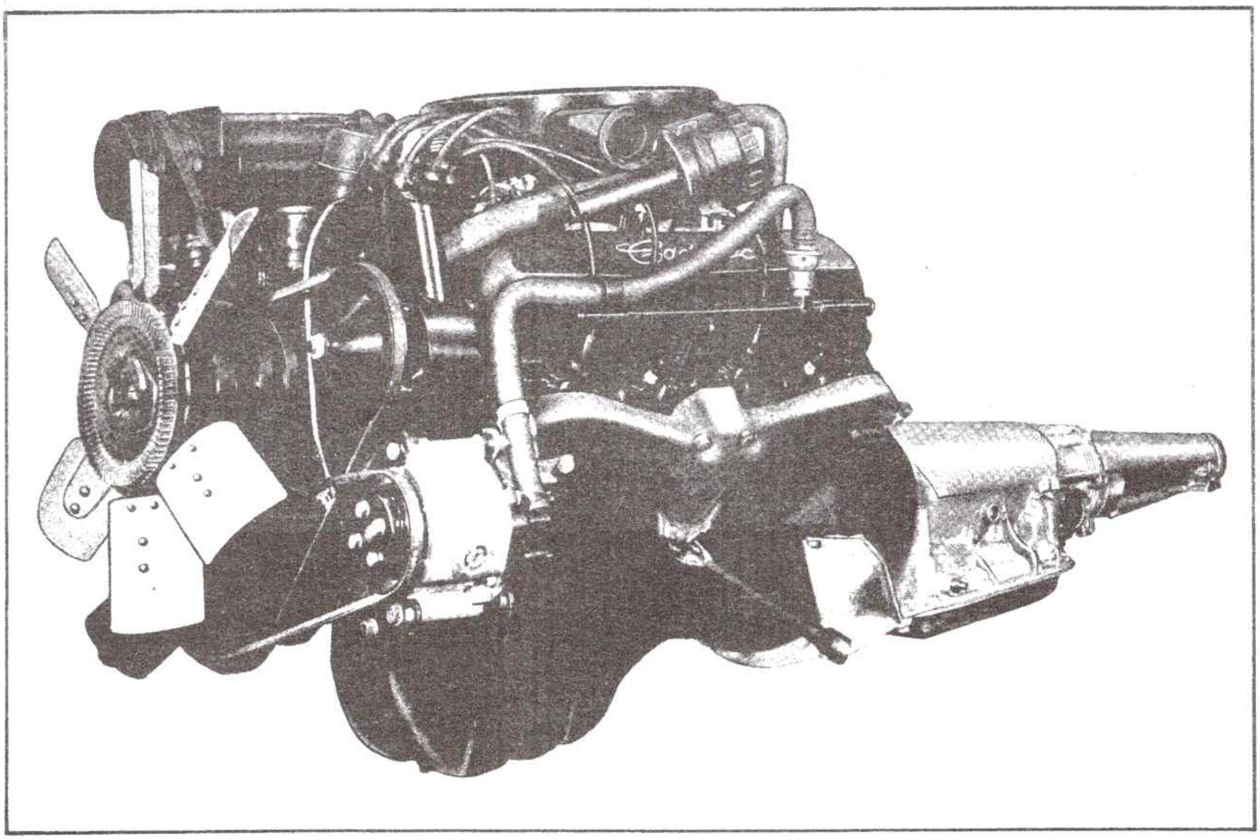


Fig. 6-114 Engine 3/4 View with Transmission

direct oil from the cylinder wall to the piston pin to provide adequate lubrication.

The camshaft is supported by five steel-backed babbitt bearings. It is driven by the crankshaft through a timing chain at the front of the engine. Both the crankshaft and camshaft sprockets have locating marks to provide correct valve timing when the timing chain is installed. Wide camshaft lobe design assures minimum lobe wear.

A drive gear, cast as an integral part of the camshaft, meshes with the drive gear on the distributor drive shaft, Fig. 6-115. The distributor drive shaft rotates in a clockwise direction when viewed from above. This shaft also drives the oil pump.

Hydraulic valve lifters are used to maintain zero operating clearance throughout the valve train. This arrangement assures quiet operation and eliminates the need for valve tappet adjustments. The lifters operate in guide holes bored in the cylinder block. The valve lifter plunger and lifter body are selectively fitted in matched pairs. The push rods ride in cups in the lifters and extend up through openings in the cylinder block and cylinder heads to the rocker arms. The valve operating mechanism is illustrated in Figs. 6-116 and 6-134.

A full flow type oil filter is attached to the oil pump cover. The filter assembly incorporates a throw away type filter element and a spring loaded by-pass valve integral with the pump

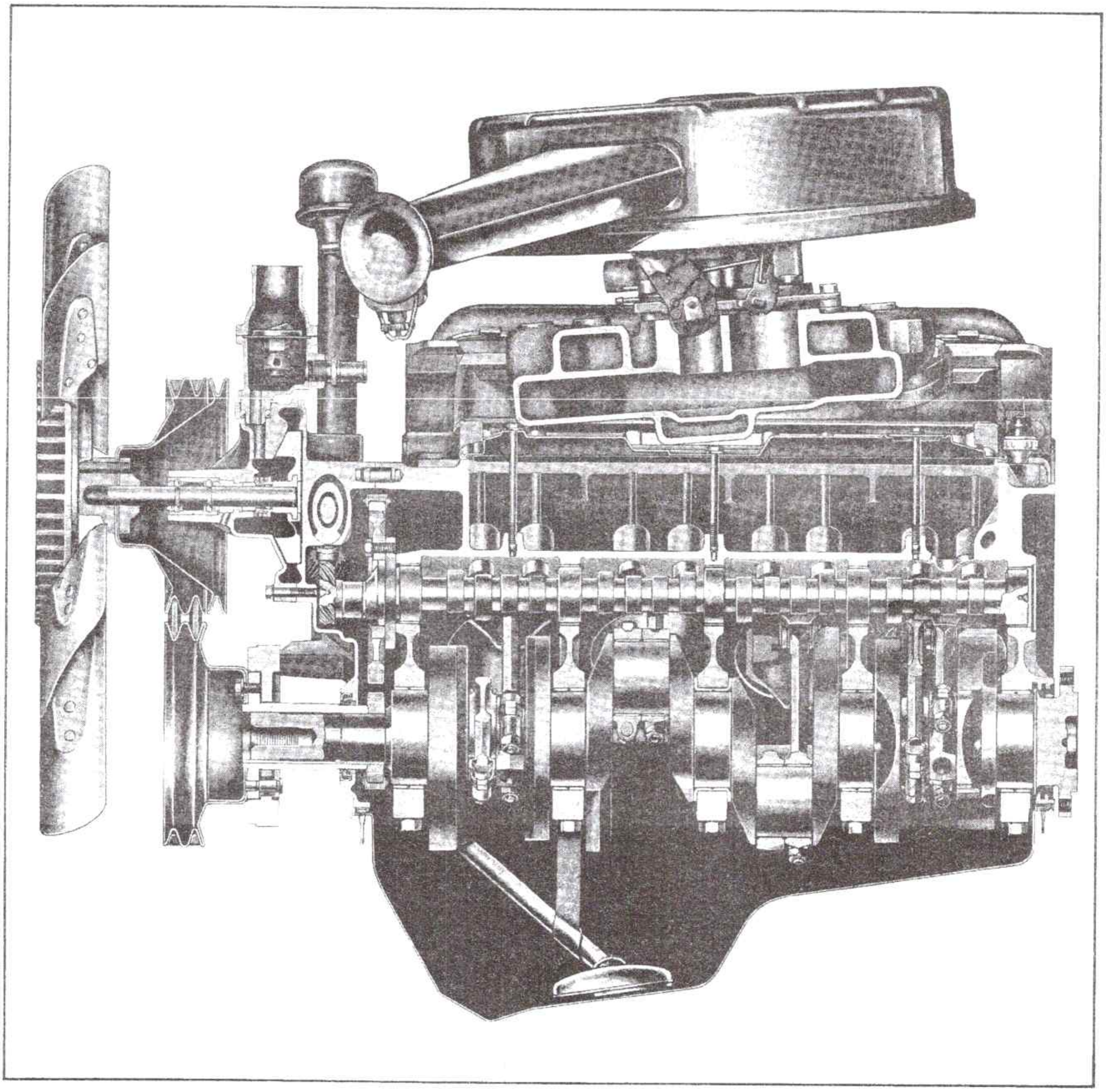


Fig. 6-115 Engine Longitudinal Section

cover assembly, to assure that the engine oil supply is not interrupted if the element should become clogged.

Oil capacity of the engine crankcase is four quarts; five quarts if the filter is changed.

Engine Lubricating System

The oil pump is mounted in the right side of the engine front cover. Oil enters the pump through a screened intake pick-up pipe, and is pumped through the oil filter, through an angular passage in the cylinder block, into the right longitudinal header, Fig. 6-117.

The right longitudinal header connects at the rear of the engine with the vertical oil header. The oil continues up the vertical header to the oil pressure signal switch, and into the connecting header, which feeds the left longitudinal header.

Main bearings No. 1, 3, and 5 are lubricated by oil from the right longitudinal header through holes drilled in the block. Main bearings No. 2 and 4 are lubricated in the same manner by oil from the left longitudinal header. Camshaft bearings No. 1, 2, 3, and 4 are lubricated by oil from

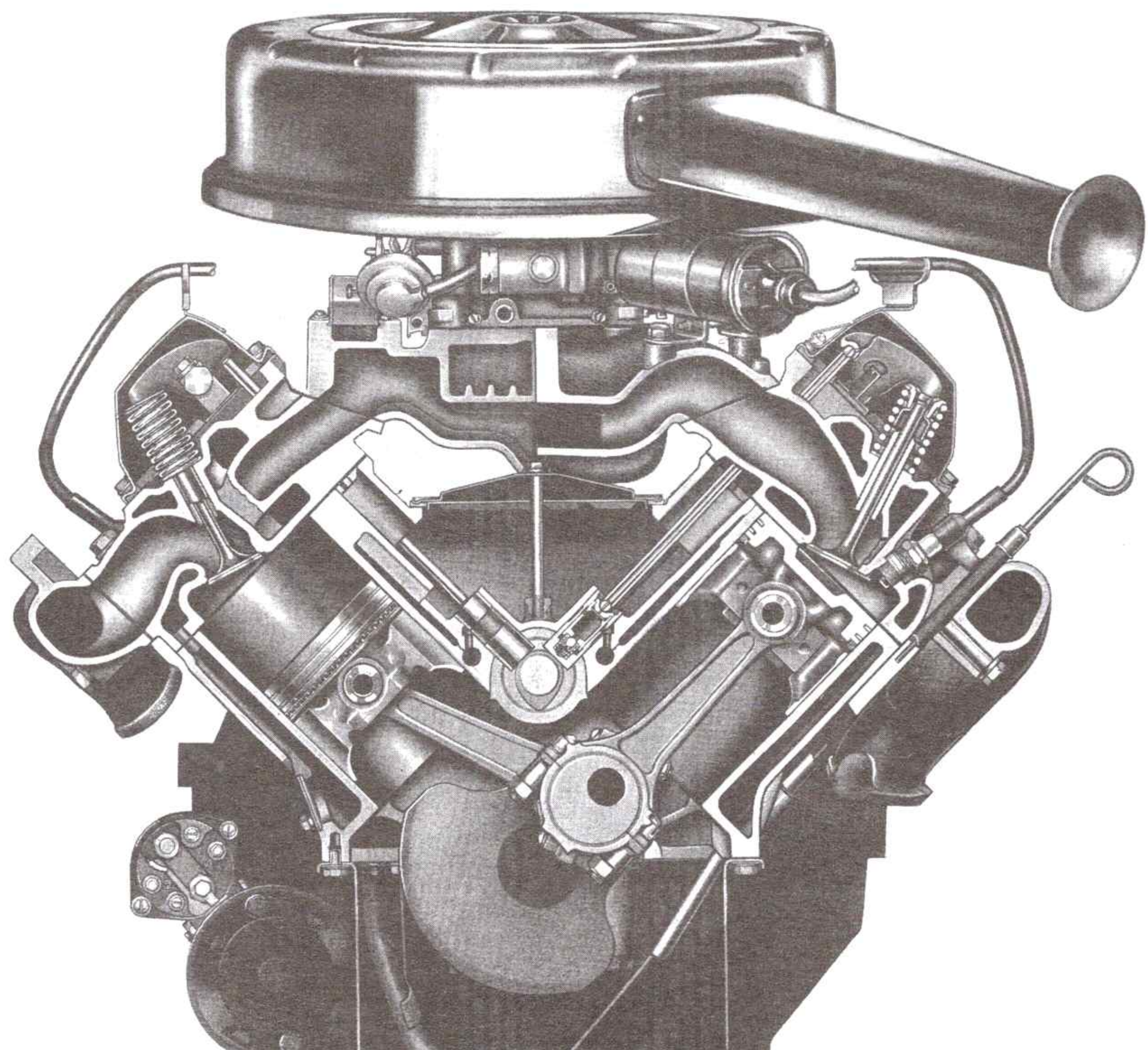


Fig. 6-116 Engine Transverse Section

the corresponding main bearings through holes drilled in the block. The No. 5 camshaft bearing is lubricated directly from the right longitudinal header. Oil from each main bearing also lubricates adjacent connecting rod bearings through holes drilled in the crankshaft. (See Fig. 6-117).

The longitudinal headers feed the hydraulic valve lifters through drilled passages. The oil then flows, under pressure, into the lifters and up through the hollow push rods to the rocker arms. The amount of oil is controlled by a small metering disk in the valve lifter.

The oil comes through a small feed hole in the rocker arm and flows onto the arm, lubricating the rocker arm bearings as well as the push rod tip and the valve tip.

Oil drains from the cylinder heads through matching holes in the heads and block to the crankcase. Oil from the valve lifter compartment returns to the crankcase through a hole at the rear of the compartment on the right side.

Information pertaining to the Crankcase Ventilation System is given in this Section under Engine Fuel, General Description.

Air Injection Reactor (A.I.R.)

a. System (Figs. 6-118 & 6-165)

The A.I.R. system is installed on all 1967 cars to be registered in the state of California. The Cadillac A.I.R. system reduces the amount of hydrocarbons and carbon monoxide in the exhaust gases by injecting fresh, filtered air directly into the exhaust port of each cylinder. The air added to the hot exhaust gases causes further oxidation of the gases before they enter the exhaust pipe.

The A.I.R. system consists of a belt-driven pump located with the front accessory group, formed rubber air hoses, sheet metal tubing referred to as "air injection manifolds" mounted on the cylinder heads, specially adapted cylinder heads and a modified carburetor. There is an intake air bleed valve located rear of the carburetor on the intake manifold and a one-way check valve to protect the hoses and pump from hot gases.

b. Air Pump

The belt-driven air pump is located on the lower left front of the engine. The front pump

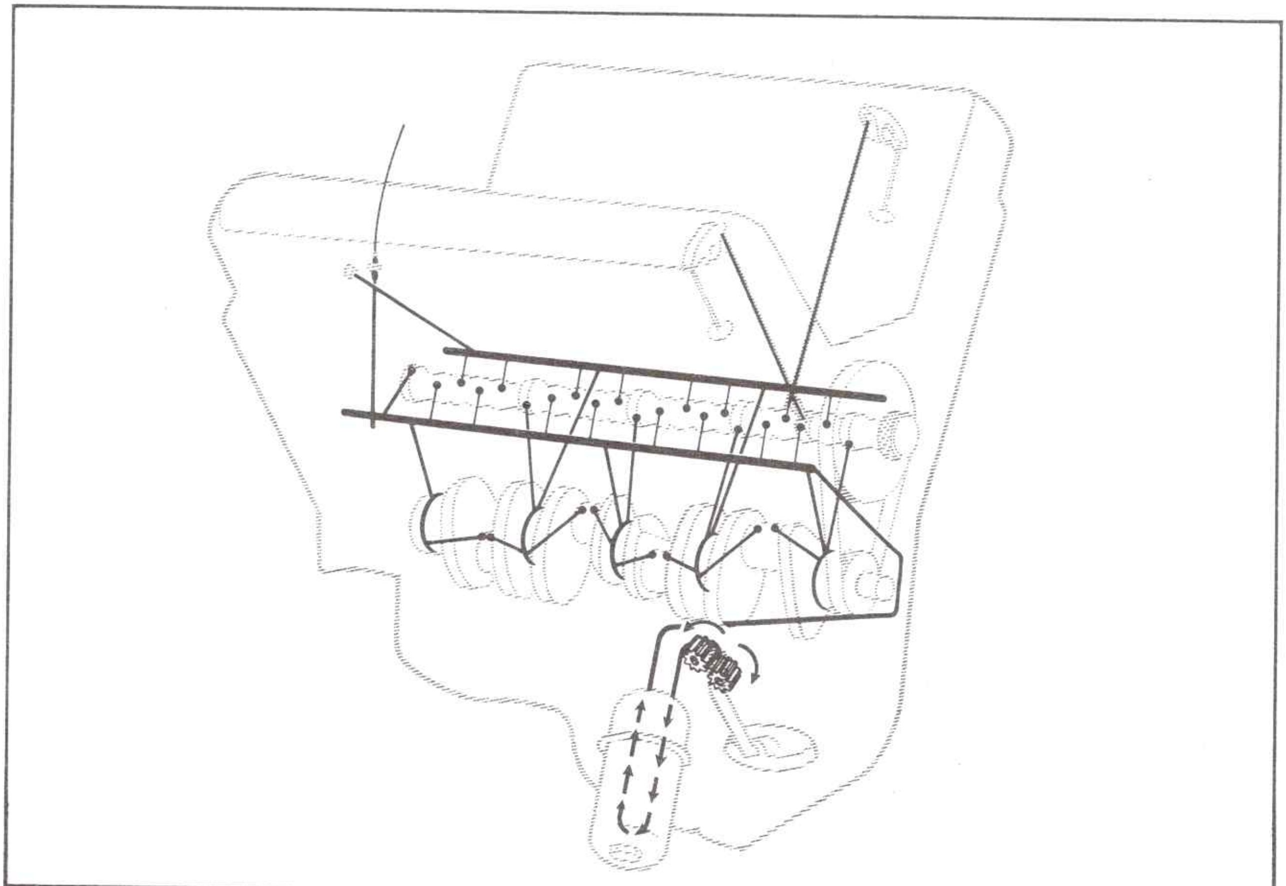


Fig. 6-117 Engine Lubricating System

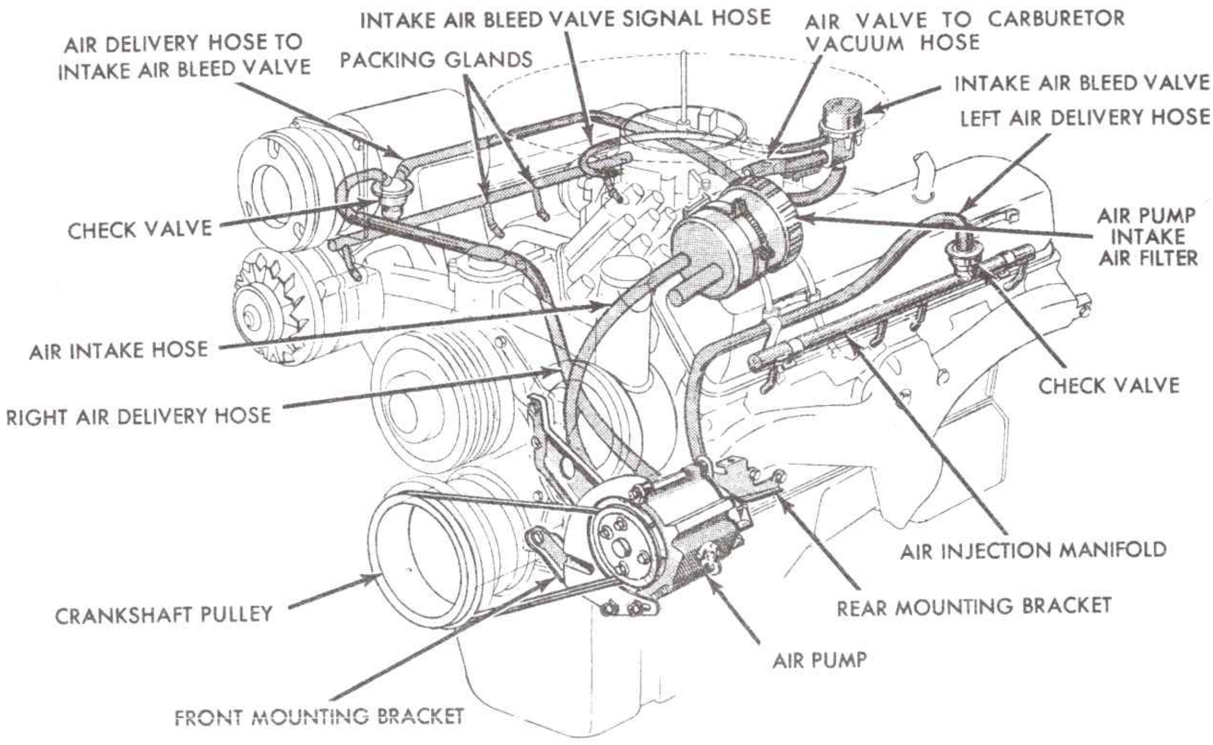


Fig. 6-118 Air Injection Reactor System

mounting bracket is attached to the engine front cover assembly. The rear pump mounting bracket is attached to the front of the left exhaust manifold. The front mounting bracket is reinforced by a strut from the cylinder block to minimize vibration. Power take-off for the pump is at the crankshaft pulley. Pump speed is one and one-half times crankshaft speed.

Intake air is supplied to the pump by a formed flexible hose of one inch inside diameter. This hose is attached to its own air cleaner mounted on the top of the left rocker arm cover on all except 693 cars, which have the cleaner mounted on the left fender dust shield, and to a one inch intake tube at the rear of the pump. Air is delivered to each air injection manifold by two formed flexible hoses of three-quarter inch inside diameter fitted to three quarter inch exhaust tubes at the rear of the pump. Hoses are secured to all fittings by clamps.

c. Air Injection Manifolds

The two air injection manifolds are slip fitted into the cylinder heads and each is held in place by two spring clips, secured by rocker arm cover screws. Each of the eight feeder tubes of the air injection manifolds is sealed by an asbestos and graphite packing gland which fits on the tube below a crimped shoulder.

d. Cylinder Heads

Each cylinder head has four five-sixteenths inch diameter drilled passages outboard of the rocker arm cover, one at each exhaust valve area, beside the spark plugs. The passages lead into the exhaust port directly behind the valve. The holes are counter-bored and chamfered to provide a seat for the feeder tube packing gland. The glands bottom on the chamfered counterbore shoulders.

e. Carburetor

The A.I.R. system will use a modified Quadrajet 4MV carburetor. The carburetor is fitted with a five-eighths inch diameter tube at the rear for the intake air bleed valve outlet hose.

The idle mixture screws have a longer needle taper to provide finer mixture adjustment.

f. Intake Air Bleed Valve and Check Valves

The intake air bleed valve is attached by a bracket to the rear of the intake manifold. It senses manifold vacuum through a three-sixteenths inch fitting at the front of the carburetor. During sudden deceleration, vacuum increase causes the valve to open, allowing air from the "Y" fitting on the right air injection manifold to pass through the valve, into the base of the carburetor through a five-eighths inch fitting. The additional air in the intake manifold leans out the air-fuel mixture to prevent "backfire". Approximate duration of the valve opening is two seconds.

Each air injection manifold is fitted with a screw-on check valve. The left check valve is near the rear of the manifold. The right check valve is near the front of the manifold and has a "Y" fitting on the upper side. One branch of the "Y" takes the air delivery hose from the air pump, the other branch takes the hose leading to the intake air bleed valve. These valves have one-way diaphragms which prevent hot exhaust gases backing up into the hoses and pump and causing damage. This will protect the system in the event of pump belt failure, abnormally high exhaust system pressure, or air delivery hose ruptures.

103. Cylinder Balance Test

The cylinder balance test is used to compare the power output of each cylinder with that of other cylinders. It is performed by operating the engine on each pair of companion cylinders (those that fire 360° apart - on Cadillac engines, 1-6, 8-5, 7-4, 2-3), and then comparing the engine vacuum and engine rpm of the four pairs.

If the readings for any pair are low, the individual cylinder may be pinpointed by operating the engine on one bank of cylinders and then the other, and comparing readings. The low bank will contain the cylinder that caused the pair to be low.

There are several cylinder balance testers on the market today. All of them permit operating the engine on a pair of cylinders simply by grounding the current to the remaining six cylinders. Always follow the instructions furnished by the manufacturer for the equipment being used.

104. Engine Front Cover Removal and Installation

a. Removal

1. Disconnect negative battery cable.

2. Remove carburetor air cleaner.

3. Drain coolant from radiator and cylinder block.

4. Remove 2 oil pan to front cover nuts and studs.

5. Loosen two hose clamps at thermostat housing and radiator inlet pipe, and remove upper radiator hose.

6. Remove four cap screws that hold fan blade assembly to water pump and remove fan blade assembly, or hub spacer and fan on non-air conditioned cars.

NOTE: Fan clutches used on air conditioned cars are always to be in an 'in car position'. When removed from car for any service procedure, support assembly to keep clutch disc in a vertical plane to prevent leaks of silicone fluid from clutch mechanism.

7. Remove power steering pump belt, generator belt and pulley.

8. Loosen two hose clamps at water pump and radiator outlet pipe, and remove lower radiator hose.

9. Remove two cap screws that hold power steering pump bracket to cylinder block and position pump and bracket to one side. Do not disconnect hoses.

10. Remove two cap screws that hold generator support bracket to cylinder head water outlet pipe, and position generator and support bracket away from engine.

NOTE: On Fleetwood Eldorado with air conditioning, partially remove compressor as described in Section 1, Note 91a. Also remove compressor lower mounting bracket attached to engine front cover.

11. Remove distributor assembly as described in Note 6-31a.

NOTE: It is not necessary to line up rotor cap before removing distributor.

12. Remove fuel pump as described in Note 102a.

13. Remove four of six cap screws that hold crankshaft pulley to harmonic balancer as shown in Fig. 6-119.

14. Remove cork plug from end of crankshaft.

15. Install Harmonic Balancer Puller Pilot, J-21052-4, in bore in end of crankshaft, Fig. 6-119.

16. Install Holding Base, J-21052-1, on front of pulley, lining up scribe mark on base with key slot in harmonic balancer, and install four holding screws with washers finger tight, Fig. 6-120. Do not use a wrench to tighten screws.

17. Thread Puller Screw, J-21052-2, into base until screw contacts pilot.

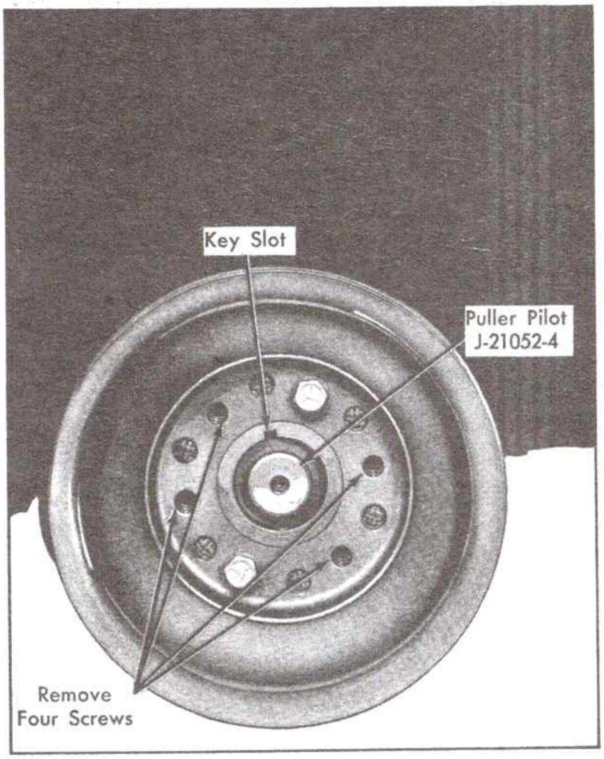


Fig. 6-119 Installing Harmonic Balancer Puller Pilot

18. Using a wrench, remove harmonic balancer assembly from crankshaft, Fig. 6-120.

NOTE: Use of shop air pressure to hold one piston within its compression stroke will make it possible to remove harmonic balancer without the crankshaft turning over. Remove an accessible spark plug, install Adapter J-9388 in spark plug port, and apply air pressure to hold piston within its compression stroke.

19. Remove pilot from end of crankshaft and remove Harmonic Balancer Puller tool from harmonic balancer.

20. On cars equipped with A.I.R. system, remove three cap screws that hold air pump front mounting bracket to engine front cover assembly. Loosen air pump drive belt adjusting bolt and remove drive belt. Swing air pump and front mounting bracket to one side.

21. Remove oil filter from oil pump cover assembly.

22. Remove four cap screws that hold cylinder head water outlet pipe to cylinder heads and remove outlet pipe. Discard flange gaskets and O-ring from neck of outlet pipe.

23. Remove cap screw and washer that hold fuel filter to bracket on oil filler tube.

24. Remove remaining nine cap screws that hold engine front cover to cylinder block and remove cover with water pump attached, Fig. 6-121. Discard gasket.

NOTE: Use caution to protect front oil pan seal and gaskets from damage during engine front cover removal.

b. Installation

1. Position new front cover gasket over locating dowels on cylinder block.

NOTE: Apply a small amount of gasket cement to hold gasket in place.

2. Install front cover, with water pump attached, over end of crankshaft, lining up dowel holes in cover with locating dowels on cylinder block. Secure with twelve attaching screws. Refer to Fig. 6-121 for proper screw location and torque specifications.

NOTE: Use caution to protect front oil pan seal and gaskets from damage during engine front cover installation.

3. Lubricate new water outlet pipe to water pump O-ring seal with silicone, and install O-ring against shoulder in bore in pump body.

4. Brush gasket cement on water outlet pipe flange surfaces and place new gaskets in position on water outlet pipe.

5. Install neck of water outlet pipe in bore in pump body, position flange surfaces against cylinder heads and install four attaching screws. Tighten screws to 20 foot-pounds.

6. Install oil filter on oil pump cover assembly.

NOTE: On Fleetwood Eldorado with air conditioning, install compressor lower mounting bracket to engine front cover. Also install compressor as described in Section 1, Note 91b.

7. Install generator support bracket on water outlet pipe and secure with two attaching screws. Tighten screws to 20 foot-pounds.

8. Secure fuel filter to bracket on oil filler tube with attaching screw and washer.

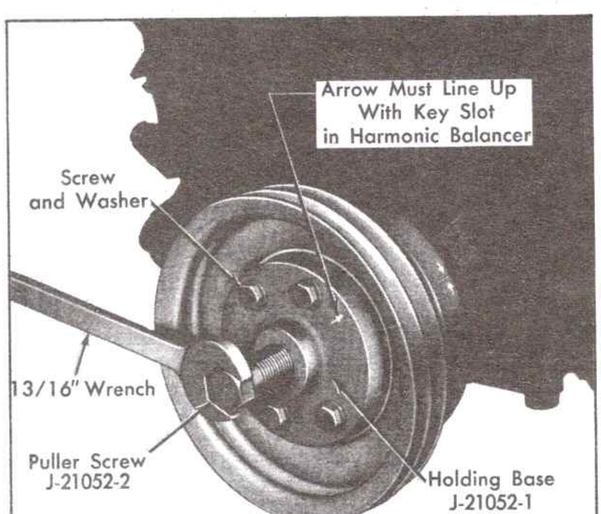


Fig. 6-120 Harmonic Balancer Assembly Removal

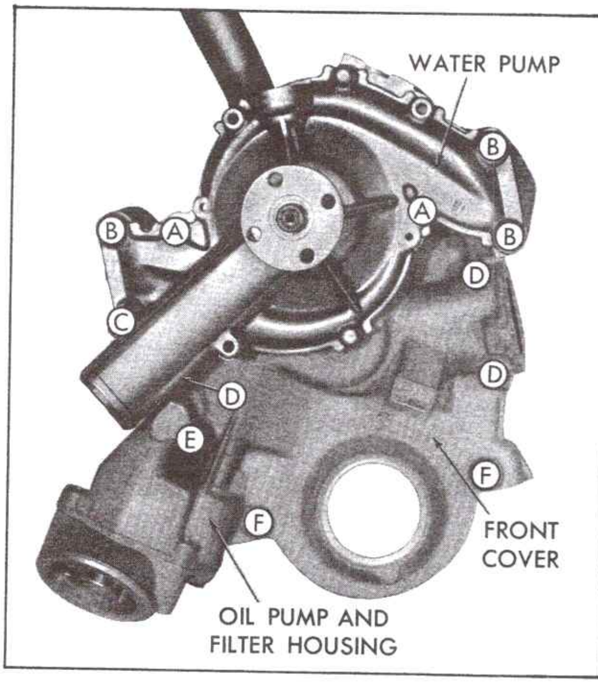


Fig. 6-121 Engine Front Cover Attaching Screws

Key	(No.)	Size	Torque
A	(2)	5/16-18 x 3-1/4	10 Foot-Pounds
B	(3)	3/8-16 x 3-5/8	20 Foot-Pounds
C	(1)	3/8-16 x 5	20 Foot-Pounds
D	(3)	5/16-18 x 2-1/8	10 Foot-Pounds
E	(1)	5/16-18 x 2-1/2	10 Foot-Pounds
F	(2)	5/16-18 x 1	10 Foot-Pounds

9. On cars equipped with A.I.R. system, position air pump and front mounting bracket on engine front cover, and secure with three attaching screws. See Fig. 6-121 for torque specifications on attaching screws.

10. Install four pulley to harmonic balancer cap screws that were previously removed and tighten all six screws to 18 foot-pounds.

11. Lubricate bore of balancer with E.P. lubricant to prevent seizure to crankshaft.

12. Position harmonic balancer assembly on crankshaft, lining up key slot in harmonic balancer with key on crankshaft.

13. Place Holding Base, J-21052-1, against front face of pulley and thread Installer Screw, J-21052-5, into end of crankshaft. Position thrust bearing with inner race forward, washer next, and Installer Nut, J-21052-6, last, Fig. 6-122.

14. Using a wrench, install harmonic balancer assembly on crankshaft.

NOTE: Use of shop air pressure, as explained in removal procedure, will make it possible to install harmonic balancer assembly without crankshaft turning over.

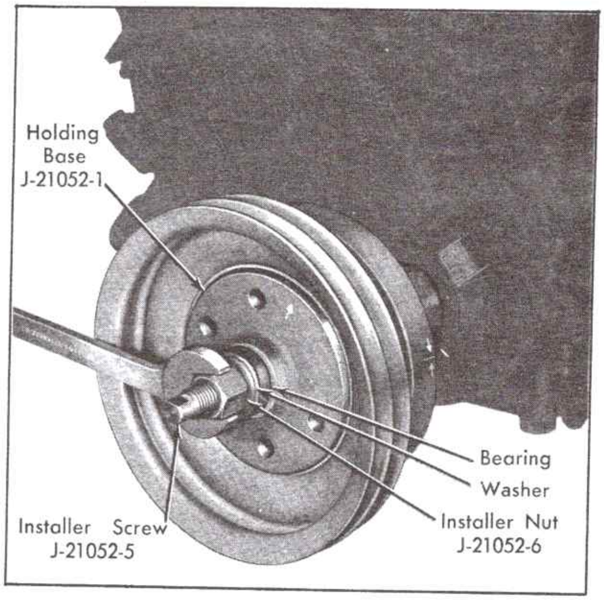


Fig. 6-122 Harmonic Balancer Assembly Installation

15. When harmonic balancer assembly is positioned on crankshaft, remove Harmonic Balancer Remover and Installer tool. Do not try to install harmonic balancer all the way with this tool, or tool will be damaged. Thread a 1962 harmonic balancer-to-crankshaft screw and washer in end of crankshaft. Tighten screw to 125 foot-pounds.

16. Remove screw and washer from end of crankshaft, install cork plug in end of crankshaft, exhaust air pressure from cylinder, remove Adapter, J-9388, and install spark plug.

17. Install fuel pump as described in Note 6-102b.

18. Install power steering pump with bracket on cylinder block and secure with two attaching screws.

19. Connect lower radiator hose at radiator outlet and water pump inlet pipe, and secure with hose clamps.

20. Install pulley and fan blade assembly on water pump and secure with four attaching screws. Tighten screws to 18 foot-pounds.

NOTE: On cars equipped with A.I.R. system, install air pump drive belt and adjust as described in Note 138b.

21. Install generator belt and adjust as described in Note 6-49 or 6-50.

22. Connect upper radiator hose at radiator

inlet pipe and cylinder head water outlet pipe, and secure with hose clamps.

23. Install power steering pump belt and adjust as described in Section 9, Note 3.

24. On cars equipped with Air Conditioning, install compressor as described in Section 1, Note 31b. Adjust compressor belt as described in Section 1, Note 13c. Install fan shroud on radiator cradle and secure with eight cap screws. Tighten screws to 12 foot-pounds.

25. Install 2 oil pan to engine front cover studs and nuts.

26. Refill cooling system with coolant.

27. Reconnect negative battery cable.

28. Install distributor assembly and adjust engine timing as described in Notes 32b and 33.

29. Install carburetor air cleaner.

30. Run engine to check for coolant and oil leaks at all connections.

105. Engine Front Cover Disassembly and Assembly

a. Disassembly

1. Remove four cap screws that hold oil pump cover assembly to pump housing and remove cover assembly, Fig. 6-123. Discard gasket.

   CAUTION: Be careful gears do not fall out of housing when cover assembly is being removed.

2. Slide drive shaft and gear, and driven gear, out of pump housing.

3. Removing remaining five cap screws that hold water pump to front cover, remove water pump. Discard gasket.

4. Remove front cover oil seal only if necessary.

b. Assembly

1. If front cover oil seal was removed, position new seal, with grooved lip facing forward, in bore of front cover. Using Seal Installer, J-21150-2,

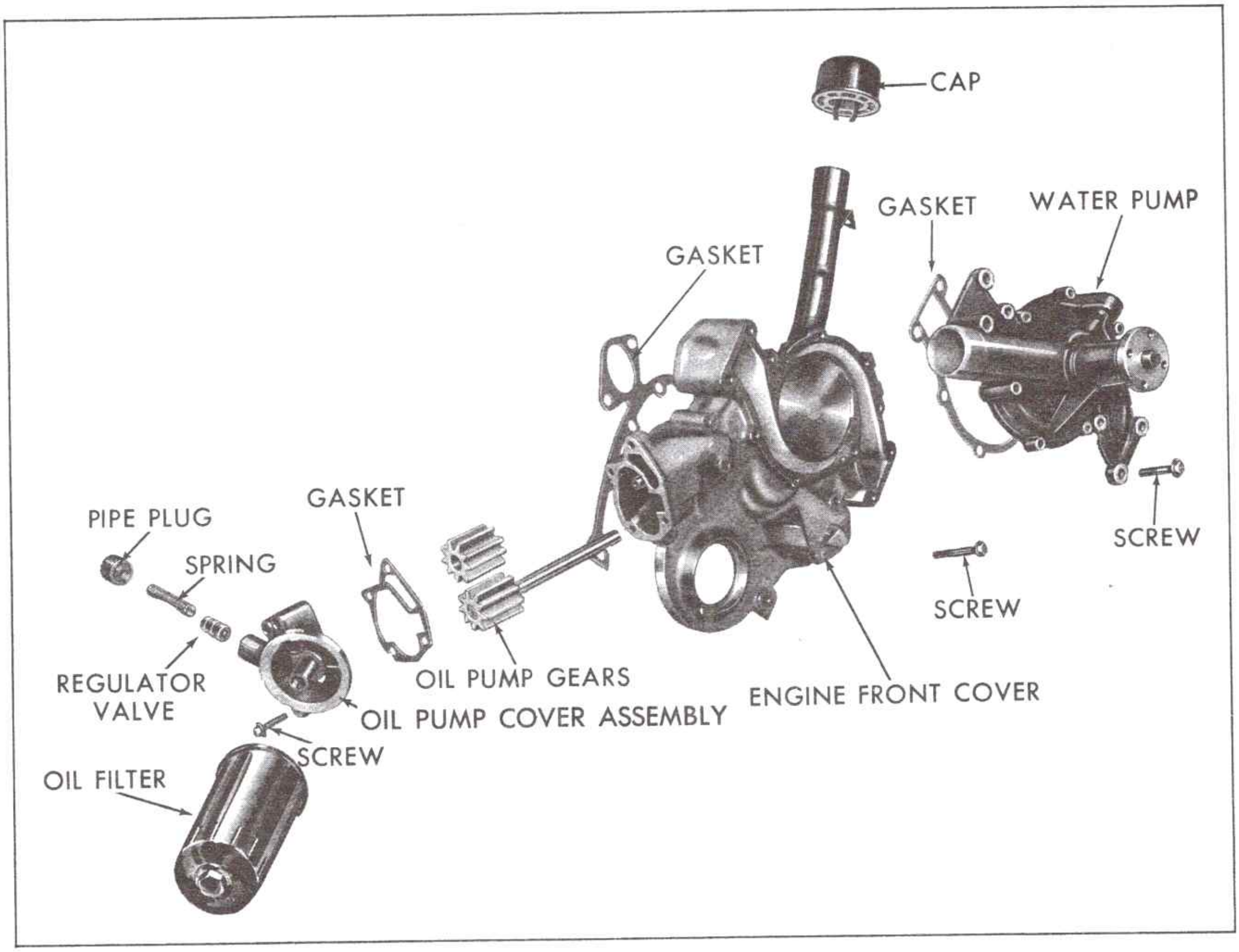


Fig. 6-123 Engine Front Cover Disassembled

Adapter, J-21150-3 and hammer, drive seal into bore of front cover until seal bottoms against shoulder of bore, Fig. 6-124.

CAUTION: Before installing seal in cover, BE SURE IT IS STRAIGHT, to avoid damage to seal and front cover.

2. Position new water pump gasket on front cover.

3. Install water pump on front cover, lining up locating dowels on front cover with dowel holes on pump body, and secure with five attaching screws. See Fig. 6-121 for screw location and torque specifications.

4. Install oil pump drive shaft and gear in oil pump housing, and slide driven gear over stationary shaft in pump housing, meshing driven gear with drive gear.

5. Using new gasket, install oil pump cover assembly on pump housing and secure with four attaching screws. Tighten screws to 5 foot-pounds.

106. Engine Front Cover Oil Seal Replacement

a. Removal

1. Disconnect negative battery cable.

2. Remove carburetor air cleaner.

3. Loosen adjusting bolt on power steering pump bracket and remove power steering pump drive belt.

4. Loosen adjusting bolt on generator bracket and remove generator drive belt.

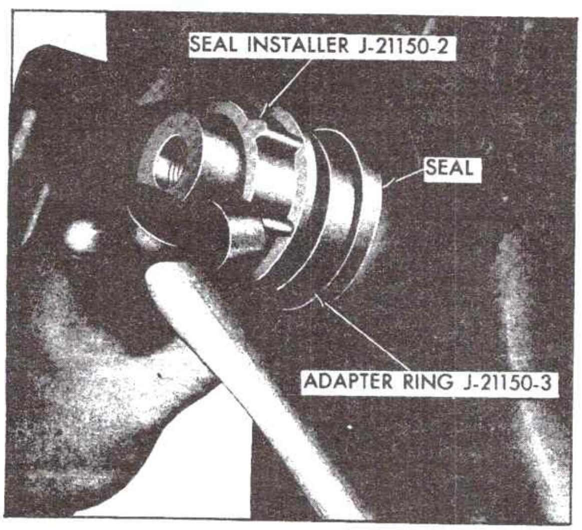


Fig. 6-124 Engine Front Cover Oil Seal Installation

5. On cars equipped with Air Conditioning, loosen adjusting bolts on Air Conditioning compressor bracket and remove compressor drive belt. On cars equipped with A.I.R. system, loosen adjusting bolt on air pump front bracket and remove air pump drive belt.

6. Raise front of car and place on jack stands.

7. Working under car, remove six cap screws that hold crankshaft pulley to harmonic balancer and remove spacer and pulley. Place scribe marks on spacer, pulley and harmonic balancer for proper re-installation.

8. Remove plug from end of crankshaft.

9. Using Harmonic Balancer Puller Pilot, J-21052-4, Fig. 6-119, in bore of crankshaft, Holding Base, J-21052-1, on front of balancer, and Puller Screw, J-21052-2, remove harmonic balancer from crankshaft, Fig. 6-120. See Note 6-104a, steps 13 through 19. Inspect the sealing surface on the harmonic balancer hub for nicks or scratches. Replace hub if not smooth.

10. With thin-bladed screwdriver or similar tool, pry out front cover oil seal. Discard seal.

b. Installation

1. Lubricate new dual lip oil seal by filling the cavity between the lips with wheel bearing grease. Position seal on end of crankshaft with garter spring side toward engine.

2. Using Seal Installer, J-21150-2, Adapter Ring, J-21150-3, and hammer, drive seal into front cover until it bottoms against shoulder in bore, Fig. 6-124.

3. Lubricate bore of harmonic balancer with E.P. lubricant to prevent seizure to crankshaft, lining up key slot in harmonic balancer with key on crankshaft.

4. Install harmonic balancer, Fig. 6-122, using Holding Base, J-21052-1, Installer Screw, J-21052-5 and Installer Nut, J-21052-6 as required. Remove balancer installer tools, and install plug in end of crankshaft, as described in Note 6-104b, steps 10 through 16.

5. Install spacer and crankshaft pulley, lining up scribe marks, and secure with six attaching screws. Tighten screws to 15 foot-pounds.

6. Remove jack stands and lower car.

7. Install power steering pump belt and adjust as described in Section 9, Note 3.

8. Install generator belt and adjust as described in Note 6-49 or 6-50.

9. On cars equipped with Air Conditioner, install compressor belt, and adjust as described in Section 1, Note 13c. On cars equipped with A.I.R. System, install air pump belt and adjust as described in Section 6, Note 138b-8.

10. Install carburetor air cleaner.

11. Connect negative battery cable.

12. Run engine and check for oil leaks at front cover.

107. Oil Pump Assembly Removal and Disassembly

The oil pump housing is an integral part of the engine front cover. Whenever the oil pump components require service, the engine front cover must be removed from the engine.

a. Removal

1. Remove engine front cover as described in Note 104a.

b. Disassembly (Fig. 6-123)

1. Remove four cap screws that hold oil pump cover assembly to pump housing and remove cover assembly and gasket. Discard gasket.

CAUTION: Be careful pump gears do not fall out of housing when cover assembly is being removed.

2. Slide drive shaft and gear and driven gear out of pump housing.

3. Using a 5/16 inch hex head wrench, remove plug from pump cover assembly, and remove oil pressure regulator valve and spring from bore in cover assembly.

108. Oil Pump Assembly—Inspection, Assembly and Installation

a. Inspection

1. Inspect oil pressure regulator valve for nicks and burrs that might cause a leak or binding condition in bore of pump cover assembly.

2. Check free length of regulator valve spring. It should be approximately 2.77 inches to 2.89 inches in length. A force of 6-1/4 to 6-3/4 pounds should be required to compress the spring to 1-7/16 inches.

3. Inspect drive gear and driven gear for nicks and burrs.

4. Inspect pump housing and pump cover assembly for wear and score marks.

b. Assembly

1. Install oil pressure regulator valve and spring in bore of pump cover assembly.

2. Using a 5/16 inch hex head wrench, install plug in cover assembly and tighten plug to 11 foot-pounds.

3. Install pump drive shaft and gear in pump housing.

4. Slide driven gear over stationary shaft in pump housing, meshing driven gear with drive gear.

5. Install pump cover assembly on pump housing, using new gasket, and secure with four attaching cap screws. Tighten screws to 5 foot-pounds.

c. Installation

1. Install engine front cover as described in Note 104b.

109. Cylinder Head Removal

1. Disconnect negative battery cable.

2. Remove carburetor air cleaner.

3. Drain coolant from radiator and cylinder block.

4. If car is equipped with Air Conditioning, partially remove compressor as described in Section 1, Note 31a, or Note 91a for 693.

5. Remove cap screw that holds transmission filler tube bracket to exhaust manifold, if right cylinder head is to be removed.

6. Remove generator as described in Note 46a or Note 60 for the commercial chassis.

7. Remove power steering pump with bracket from cylinder block and position pump and bracket to one side, if left cylinder head is to be removed. Do not disconnect hoses.

8. On cars equipped with Cruise Control, disconnect accelerator linkage rod at control unit.

9. Disconnect wire from temperature indicator switch, and remove engine oil dipstick, if left cylinder head is to be removed.

10. Disconnect, at cowl, ground strap from rear of cylinder head.

11. Remove two cap screws that hold generator support bracket to cylinder head water outlet pipe and remove bracket.

12. Disconnect upper radiator hose at thermostat housing.

13. Remove three remaining cap screws that hold cylinder head water outlet pipe to cylinder heads and remove water outlet pipe. Discard flange surface gaskets and O-ring seal from neck of water outlet pipe.

NOTE: On cars equipped with Air Conditioning, remove four cap screws that hold water outlet pipe to cylinder heads.

14. Disconnect spark plug wires at plugs, and disconnect spark plug wire retainer clip from clip retainer bracket.

15. Disconnect high voltage wire at ignition coil and remove distributor cap from distributor.

16. If left cylinder head is to be removed, disconnect ignition coil wiring from tab on rocker arm cover.

17. On cars equipped with A.I.R. system, release hose clamps and disconnect air delivery hose at check valve fitting. If working on left cylinder head, remove bolt that holds air pump to rear air pump mounting bracket; remove pump filter from left rocker arm cover and set aside with hoses attached. If working on right cylinder head, release hose clamp and disconnect intake air bleed valve hose at check valve fitting.

18. Remove rocker arm cover screws and remove rocker arm covers, secondary wiring, and distributor cap as an assembly. Discard rocker arm cover gaskets.

19. Disconnect vacuum advance line from vacuum advance unit on distributor.

20. Disconnect idle speed-up control vacuum line at idle speed-up control unit, if car is equipped with Air Conditioning.

21. Disconnect distributor primary wire at negative terminal on ignition coil, and ignition resistor wire at positive terminal.

22. Disconnect power brake vacuum hose from fitting on manifold.

23. Disconnect transmission vacuum hose and parking brake vacuum hose from fitting at rear of intake manifold.

24. Remove transmission vacuum modulator hose at transmission.

25. Remove transmission vacuum modulator hose at back of manifold and remove pipe.

26. Remove three wires at transmission downshift switch.

27. Disconnect throttle return spring and throttle control linkage at carburetor throttle lever.

28. Release rear ventilator valve hose clamp and remove hose from fitting.

29. Disconnect and remove fuel line between carburetor and fuel filter.

30. Remove four cap screws and four nuts with washers that hold intake manifold to cylinder heads.

31. If left cylinder head on the 693 with Cruise Control is to be removed, the control power unit and bracket must be removed from back of left cylinder head.

32. Lift intake manifold off locating dowels on cylinder heads and remove manifold with carburetor attached.

33. On cars equipped with A.I.R. system, lift intake manifold with carburetor and intake air bleed valve attached.

34. Remove six screws securing exhaust manifold to head.

35. Loosen cylinder head cap screws that hold rocker arm assemblies to cylinder head and remove assemblies with screws attached.

36. Remove push rods through openings in cylinder heads.

37. Remove thirteen remaining cap screws that hold cylinder head to cylinder block.

38. To remove left cylinder head, remove No.

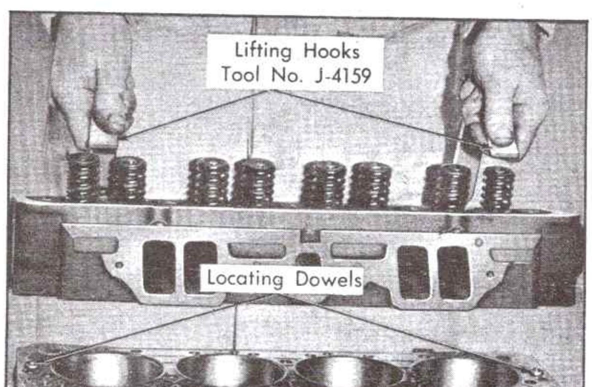


Fig. 6-125 Cylinder Head Removal and Installation

1 and No. 5 spark plugs and install Cylinder Head Lifting Hooks, J-4159, in spark plug holes. To remove right cylinder head, remove No. 2 and No. 6 spark plugs and install lifting hooks.

39. Lift cylinder head off dowels and remove from cylinder block, Fig. 6-125.

40. Discard gasket.

110. Cylinder Head Disassembly

1. Remove all spark plugs.

2. Remove exhaust manifold.

3. Place cylinder head upside down in Cylinder Head Holding Stand, J-3064.

4. Place Holding Strap, J-3064, over valve heads to hold them in place while compressing springs and clamp in position on head with thumb screw provided.

NOTE: If interference is noted when strap is installed on cylinder head, it will be necessary to grind approximately 1-3/16 inches from side of strap, at point of interference.

5. Invert head and place Valve Spring Compressor Bar over valve stem, Fig. 6-126.

6. Using foot stirrup, compress valve spring and remove valve locks.

7. Release compressor bar and remove valve spring retainer and spring. Repeat for each valve.

8. Invert head in stand, remove holding strap, and remove valves from head, being sure to keep them in order so that they can be reinstalled in the same locations.

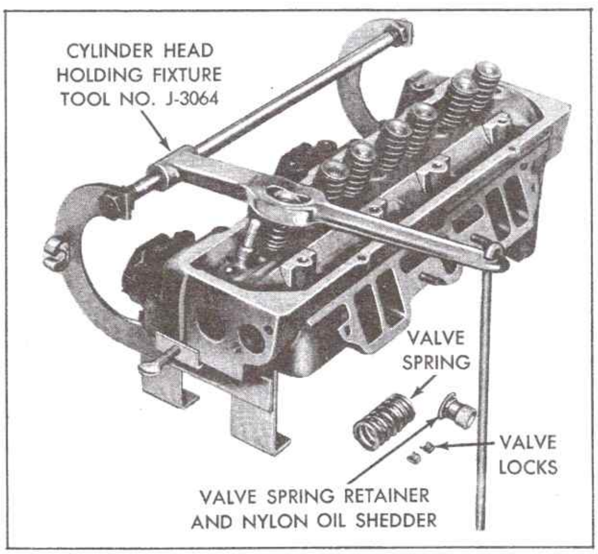


Fig. 6-126 Valve Spring Removal

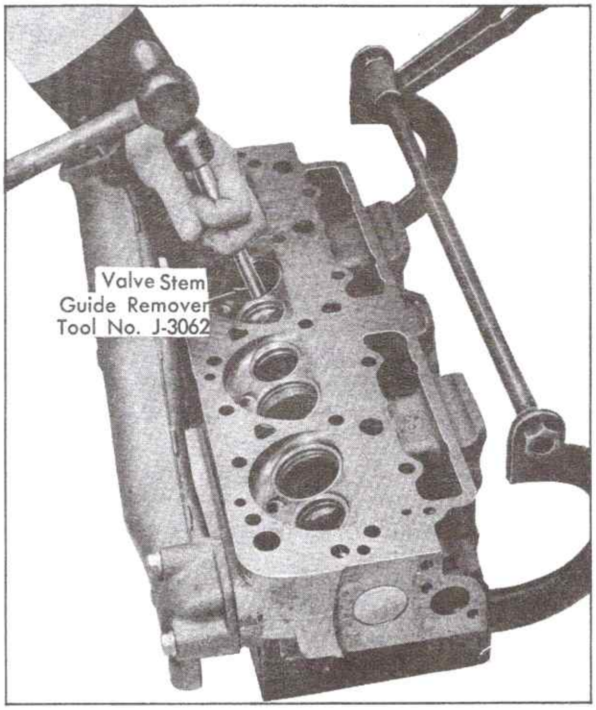


Fig. 6-127 Valve Guide Removal

9. If it is necessary to remove valve guides because of excessive clearance between valve stem and valve guide as specified in Note 112, drive out guides from bottom side of cylinder head, using Valve Stem Guide Remover, J-3062, as shown in Fig. 6-127.

111. Valve Spring or Valve Stem Oil Shedder Replacement (Fig. 6-128)

NOTE: If cylinder head has been removed from engine, use steps 8, 9, 10 and 11.

1. Disconnect negative battery cable.

2. Remove carburetor air cleaner.

3. Disconnect spark plug wires at spark plugs.

NOTE: On cars except 693 Fleetwood Eldorado, equipped with Air Conditioning, partially remove compressor as described in Section 1, Note 31a.

4. If working on left side of car, remove engine oil dipstick and disconnect coil positive wiring from left rocker arm cover. On cars equipped with Cruise Control, remove cotter pin from accelerator linkage and separate accelerator linkage from exterior arm.

5. Remove four cap screws that hold rocker arm cover to cylinder head and remove rocker arm cover. Discard gasket.

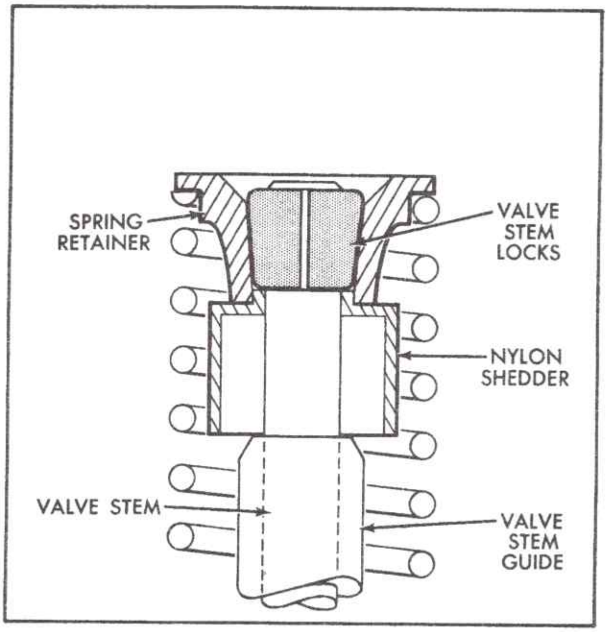


Fig. 6-128 Valve Spring Retainer and Oil Shedder

6. Loosen cap screws that hold rocker arm assemblies to cylinder head and remove rocker arm assemblies with screws attached.

7. Remove spark plug at affected cylinder, install Adapter J-9388 in spark plug port, and apply air pressure to hold valve up and seated when spring is being compressed, as shown in Fig. 6-129.

CAUTION: Keep hands away from fan blade until air pressure is established within the cylinder because, when air is applied, the crankshaft will turn quickly until the piston reaches bottom dead center.

8. Reinstall rocker arm cap screw nearest to affected valve, position end of Valve Spring Compressor, J-5892-1, under head of cap screw, and depress valve spring and retainer as shown in Fig. 6-129.

9. Remove valve locks, valve spring retainer and oil shedder and spring.

10. Install new spring and/or new spring retainer and oil shedder on spring. Compress spring and insert valve locks.

11. Remove rocker arm cap screw used to position end of Valve Spring Compressor, J-5892-1. Exhaust air from cylinder, remove Adapter, J-9388, and install previously removed spark plug.

12. Install rocker arm assembly with attaching screws on cylinder heads, making sure rocker arm sockets are seated over tops of push rods,

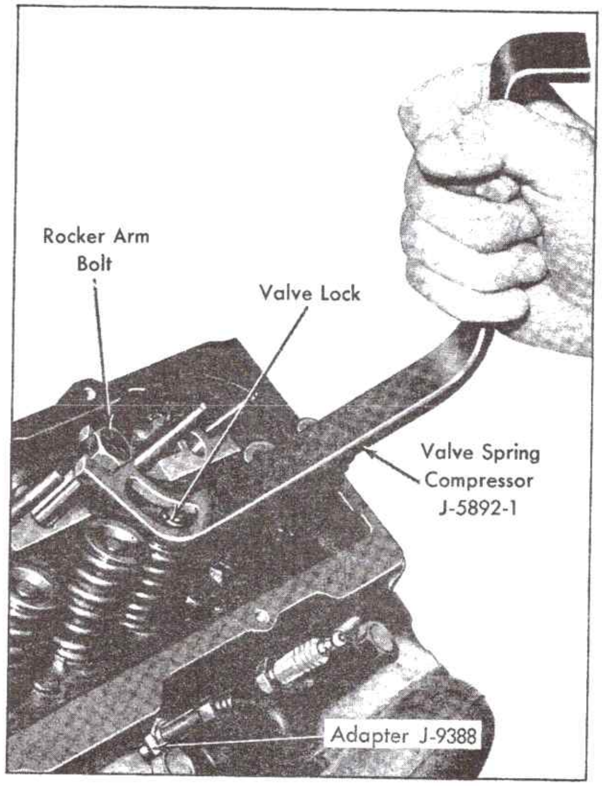


Fig. 6-129 Compressing Valve Spring

and bottoms of push rods are seated in their lifter cups. Tighten screws to 60 foot-pounds.

13. Install rocker arm cover on cylinder head, using new gasket, and secure with four attaching screws. Tighten screws to 28 inch-pounds.

14. If work was performed on left side of car, install engine oil dipstick. On cars equipped with Cruise Control, connect accelerator linkage rod to exterior arm and secure with cotter pin.

15. If work was performed on right side of car, except 693, equipped with Air Conditioner, install compressor as described in Section 1, Note 31b.

16. Connect spark plug wires at plugs.

17. Install carburetor air cleaner.

18. Connect negative battery cable.

19. Operate engine to obtain operating temperature and re-torque rocker arm cover screws to 28 inch-pounds.

112. Valve and Seat Reconditioning

Valve reconditioning is normally required less frequently in engines having hydraulic valve lifters. When this work is done, the close limits given in the engine specifications, Page 6-141 must be maintained.

Check valve stem to guide clearance using a hole gage and an outside micrometer. Measure valve guide inside diameter with hole gage, cross-ways to engine, at both top and bottom of guide, measuring gage each time with micrometer.

Measure valve stem diameter with micrometer and subtract from greater of two guide measurements to obtain maximum clearance. If clearance is greater than .005 inch, guide should be replaced to prevent excessive oil consumption and improper seating of valves.

After new valve guide has been installed, recheck valve stem to guide clearance. If clearance is still greater than .005 inch, replace the valve.

An alternate method of checking valve stem to guide clearance, if a hole gage is not available, is by using a 1/16 inch wide strip of .005 inch brass shim stock on a "no-go" basis.

Bend end of shim and hang in end of valve guide, with tip extending towards push rod side of head. Shim should not extend more than 1/4 inch into guide. If valve stem will enter guide, clearance is excessive and guide should be replaced.

Check concentricity of all valve seats. This should be within .004 inch total, as measured with dial indicator and a solid, slightly tapered pilot which has a slight bind in the valve guide when installed.

CAUTION: A pilot of the correct size must be used. Do not attempt to drive pilot into guide. Pilots with adjustable diameters to fit various sized guides are not recommended.

Grind valves to within .002 inch indicator reading when new valves and guides are being installed, or if concentricity, seat width, or full contact of valves is not as specified.

Check seat width and location on valve to insure proper heat dissipation and prevent build up of carbon on seats. Condition valve seat to a width of 3/64 to 1/16 inch. This seat width will insure good idle stability.

Valve seats should be cut so that the seat is 1/16 inch smaller in diameter than the valve head, Fig. 6-130, to allow heat to escape and to provide maximum life for newly ground valves. The diameter of the seat can be checked by placing valve in position and then rotating to get a contact pattern with the seat.

New valves have a face angle of 44° to provide a line contact between the head of the valve and the valve seat in the cylinder head, which assures good seating of the valve and less chance of burning the valve head due to exhaust gas leakage. When reconditioning valves, always grind valve face angle to 44°.

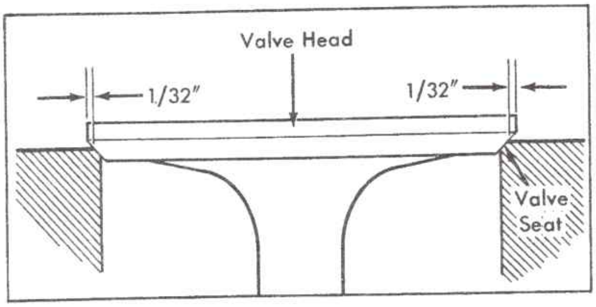


Fig. 6-130 Valve Seat Diameter

New valves should not have more than 1/64 inch wide contact with valve seats (due to 1° difference in angle). Grinding of valves by hand with grinding compound or lapping to seat them is not recommended. Use only precision equipment for valve and seat reconditioning, and follow equipment manufacturer's instructions.

113. Cylinder Head Assembly

a. Installation of Valve Guides

If any valve guides were removed, new ones should be installed as follows:

1. Position Valve Stem Guide Driver, J-22315 through Gaging Block, J-6535, Fig. 6-131.

2. Slide valve guide on installer pilot and lubricate outer surface of guide.

CAUTION: Be sure end of valve guide with longest chamfer enters bore first, pointing toward rocker arm side of head.

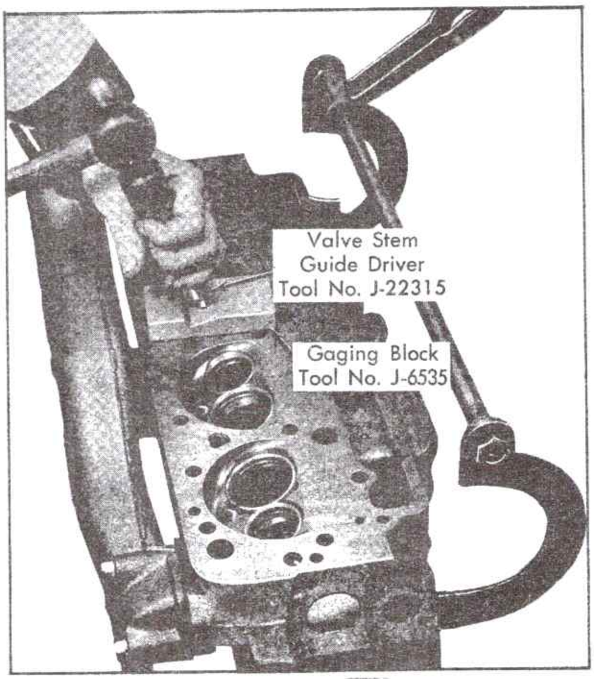


Fig. 6-131 Valve Guide Installation

3. Drive guide into cylinder head until shoulder on installer contacts plate on cylinder head. Flat side of valve guide plate rests on cylinder head, while notched portion, which acts as a stop for driving tool, faces up.

b. Installation of Valves

1. Install all valves in their respective guides and install Holding Strap, J-3064, over valve heads to hold them in place while installing springs. Coat valve stems liberally with a good grade of engine oil.

2. Place cylinder head in Holding Fixture, right side up.

3. Place spring over valve, being sure bottom of spring is in recess in cylinder head. End of spring with closely wound coils should be placed against cylinder head.

4. Place spring retainer over valve and spring.

5. Place Thimble, J-3064-12, over valve stem with tapered portion seated in valve spring retainer.

6. Using Foot stirrup, compress valve spring and then remove Thimble.

7. Place valve retainer locks in position and release tension on foot stirrup.

8. Tap ends of valve stems to seat valve retainer locks.

114. Rocker Arm Assembly—Disassembly and Assembly

a. Disassembly

1. Remove four mounting cap screws.

2. Remove each retainer and mark so that it can be put back in the same position.

3. Remove rocker arm support assemblies from retainers and remove rocker arms from supports Fig. 6-132. Be sure to keep the supports and rocker arms in order so they can be installed in the exact same position.

b. Assembly

CAUTION: Be certain the cylinder head, retainers, and supports are clean, to assure flat seating of the retainers and supports.

1. Install rocker arms on supports and place supports in retainers as shown in Fig. 6-132.

NOTE: Be sure that "EX" on support is positioned toward the exhaust valve and "IN" toward intake valve.

2. Put cap screws through the reinforcements, supports and retainers; position assemblies on the cylinder head. Make sure that push rods are properly seated in the lifter seats and in the rocker arms.

NOTE: Lubricate rocker arm bearing surfaces before assembling, in order to prevent wear.

3. Tighten four mounting screws and torque to 60 foot-pounds.

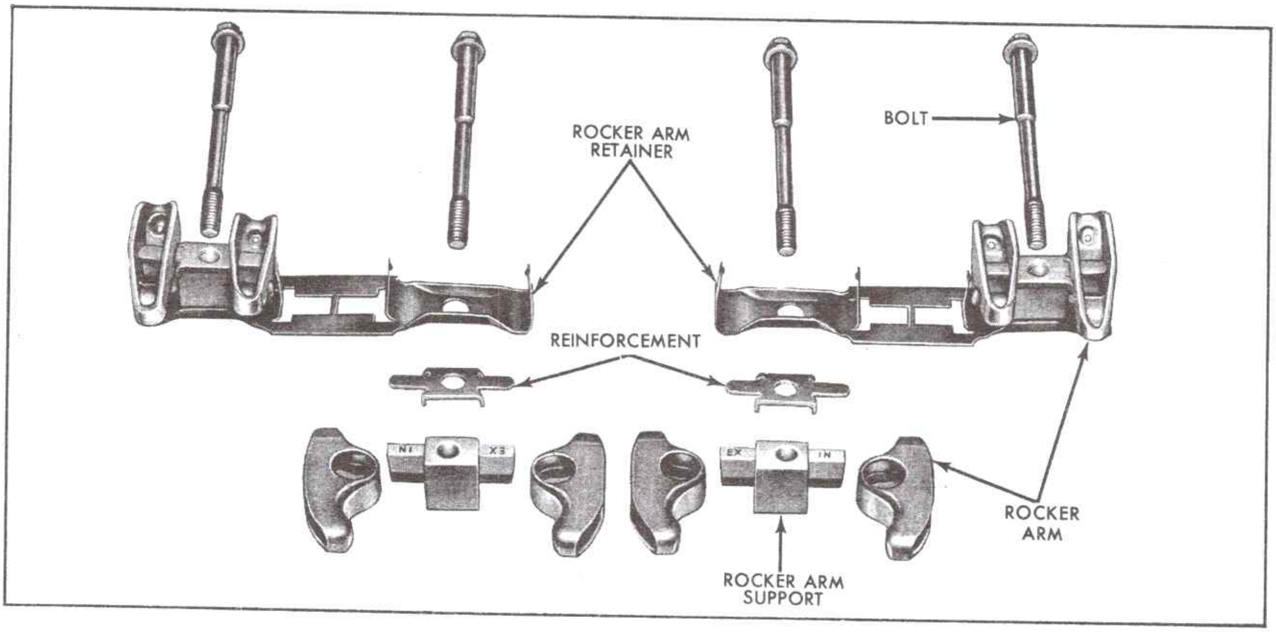


Fig. 6-132 Rocker Arm Assembly Disassembled

115. Cylinder Head Installation

1. Apply a coat of high compression gasket cement to both sides of new cylinder head gasket.

CAUTION: Extreme care must be used when installing cylinder head gaskets to assure freedom from dirt particles between the gasket and the cylinder block or head. Any foreign material can cause water or compression leaks. Blow out cylinder head passages and wipe machined surfaces of cylinder head and block clean.

2. Install gasket over dowels in cylinder block with side stamped "TOP" facing upward.

3. Using Cylinder Head Lifting Hooks, J-4159, place cylinder head in position over dowels.

4. Install thirteen cylinder head cap screws in lower and center rows and tighten finger tight.

5. Remove Cylinder Head Lifting Hooks J-4159, and install spark plugs, tightening to 25 foot-pounds.

6. Install push rods through openings in cylinder head. Bottoms of push rods must be seated in hydraulic valve lifter cups.

7. Install rocker arm assemblies with attaching screws, in position on cylinder head. Tops of push rods must be seated in rocker arm sockets. Install cylinder head cap screws as shown in Fig. 6-133.

NOTE: Care should be taken when installing cylinder head cap screws to make certain they are installed in the proper holes. Otherwise, the threads can be stripped when the bolts are tightened.

8. Tighten all cylinder head cap screws to 60 foot-pounds starting from center row and working outward and toward each end.

Cylinder head bolt locations and bolt lengths are shown in the following chart. Use this chart in conjunction with Fig. 6-133 when installing cylinder head bolts.

9. Install exhaust manifold and secure with six attaching screws. Tighten screws to 58 foot-pounds.

CAUTION: Be sure face of manifold heat valve stamped "TOP" is next to left manifold.

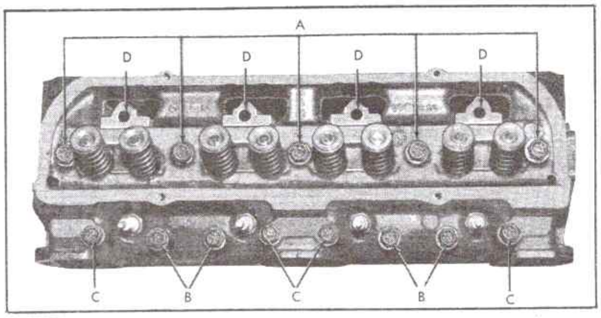


Fig. 6-133 Cylinder Head Cap Screw Location & Length

Bolt Location	Length
A	4.06"
B	2.75"
C	3.69"
D	5.94"

10. Apply a coat of gasket cement to both sides of new intake manifold gaskets, and install gaskets in position over locating dowels.

11. Install intake manifold with carburetor on cylinder heads, being sure manifold is positioned correctly over locating dowels.

12. Install two front corner cap screws and four nuts with washers that hold intake manifold to cylinder heads.

13. Install remaining two rear corner screws that secure intake manifold to cylinder heads.

14. Tighten four cap screws to 30 foot-pounds, and four nuts to 25 foot-pounds.

15. Install fuel line between carburetor and fuel filter.

16. Connect small ventilator valve hose to fitting and secure with hose clamp.

17. Connect throttle control linkage to carburetor throttle lever and secure linkage with throttle return spring.

18. Secure transmission vacuum modulator pipe by connecting hose at transmission with clamp, connecting pipe at fitting on rear of manifold.

19. On the 693 with Cruise Control, install control power unit and bracket on back of left cylinder head if removed.

20. Connect three wires at transmission downshift switch, observing color code.

21. Connect parking brake vacuum hose to fitting on rear of intake manifold.

22. Connect power brake vacuum hose to fitting on manifold.

23. Connect vacuum reserve tank hose to fitting at rear of intake manifold.

24. Connect distributor primary wire to negative terminal on ignition coil, and ignition resistor wire to positive terminal.

25. Connect idle speed-up control vacuum line at control unit, if car is equipped with Air Conditioning.

26. Connect vacuum advance line to vacuum advance unit on distributor.

27. Install rocker arm covers, secondary wiring, and distributor cap as an assembly, using new gasket.

28. Install rocker arm cover attaching screws and tighten to 28 inch-pounds.

29. Position ignition coil positive wiring.

30. Install distributor cap on distributor and connect high voltage wire to ignition coil.

31. Connect spark plug wires at plugs, and connect spark plug wire retainer clip to retainer bracket.

32. Lubricate new water outlet pipe O-ring seal with silicone, and install O-ring against shoulder in bore in pump body.

33. Brush gasket cement on water outlet pipe flange surfaces and place new gaskets in position on water outlet pipe.

34. Install neck of water outlet pipe in bore in pump body and position flange surfaces against cylinder heads. Install three (of the four) attaching screws, and tighten screws to 20 foot-pounds. Do not install screw that holds generator support bracket at this time.

35. On cars equipped with Air Conditioning, install all four cap screws that hold water outlet pipe to cylinder heads.

36. On cars equipped with A.I.R. system, connect air delivery hose at check valve fitting and secure with hose clamp. If working on left cylinder head, install air pump to rear air pump mounting bracket screw and tighten to 20 foot-pounds; replace pump filter on left rocker arm cover with hoses attached. If working on right cylinder head, connect intake air bleed valve hose at "Y" fitting and secure with hose clamp.

37. Install generator support bracket on cylinder head water outlet pipe and secure with two attaching screws. Tighten screws to 20 foot-pounds.

38. Connect ground strap from cowl to rear of cylinder head.

39. Install generator as described in Section 6 Note 48b, if right cylinder head was removed.

40. Adjust generator belt as described in Section 6. Note 49 or 50, except on 693 with Air Conditioning.

41. Connect wire to temperature indicator unit and install engine oil dipstick, if left cylinder head was removed. On cars equipped with Cruise Control, connect accelerator linkage rod to control unit.

42. Install power steering pump and bracket on cylinder block and secure with two attaching screws, if left cylinder head was removed. Adjust power steering pump belt as described in Section 9, Note 3.

43. If right cylinder head was removed on cars equipped with Air Conditioning, install compressor as described in Section 1, Note 31b or Note 91b for 693.

44. Install carburetor air cleaner.

45. Connect negative battery cable.

46. Fill cooling system.

47. Operate engine to normal operating temperature and re-torque rocker arm cover screws. Check for coolant and oil leaks at all connections.

48. Perform throttle rod adjustment as outlined in Note 6-94 or 6-95.

116. Valve Lifters—Noisy Operation

Noisy operation of valve lifters may be due to:

a. Incorrect Oil Level in Crankcase

Oil level should never be above, nor more than a quart below "Full" mark on indicator. If level is too high, foaming may result, if too low, air may enter pump inlet. In either case, noisy valve action may result.

b. Improper Oil Pressure

If valve action is noisy after the oil is hot, it may be due to low oil pressure.

Low pressure usually results from an external leak in the engine lubrication system, a stuck or improperly operating oil pressure relief valve, scored parts, worn bearings, worn oil pump gears, clogged oil intake strainer screen assembly, or poor operation of oil pump.

c. Rusty or Varnished Valve Stems or Valve Guides

This condition may be associated with short trip operation, poor quality engine oil, or failure to change oil regularly.

d. Weak Valve Lifter Springs

These can cause noisy valve operation by causing sluggish plunger movements in the cylinder. To check these springs, disassemble plunger assembly, clean thoroughly and reassemble. Check pressure to compress spring with lifter dry.

If pressure required to compress spring 11/32 inch is less than 6-1/4 pounds, the assembly should be replaced.

e. Dirty, Worn, or Scored Valve Lifter Parts

A recurring tap or click, synchronized with valve action, indicates trouble in a single lifter assembly, which should be disassembled and checked for:

1. Dirt or foreign particles, which can be removed after disassembly by wiping with a soft cloth and washing in kerosene.

2. Varnish or heavy sludge material, which can be removed by the use of a proper solvent.

NOTE: The engine oil pan should always be removed and cleaned when dirt has been responsible for sticking lifters. The oil passages from the header to the lifter bores should also be cleaned thoroughly by blowing out with kerosene and air.

3. Pitting and scoring of surfaces, which may result from gritty particles, excessive wear, poor grade oil, or damage during installation. This condition requires replacement of the complete unit.

4. Incorrect clearance between cylinder and plunger, usually caused by mismating of parts. These parts are selectively fitted in manufacturing and are not interchangeable, Fig. 6-134.

f. Lifters That Do Not Turn in Their Bores

Scoring, surface flaking, cupping or excessive wear on the bottom of the lifter may prevent the lifters from turning in their bores.

g. Other Causes

Excessive wear on either end of rocker arm or at rocker arm support; worn valve stems or push rods; worn camshaft lobes; air in suction side of oil pump system.

117. Valve Lifter Leak-Down Rate Checking

The Valve Lifter Leak-Down Rate Tester, J-3074, is used to obtain a comparison of leak-down rates of hydraulic valve lifters without removing them from the engine. With this tool, a feeler gage of a given thickness is placed between the rocker arm and the valve stem, causing valve spring pressure to force oil out of the lifter.

A spring, attached to the tool and compressed against the valve spring retainer, ejects the feeler gage when the lifter has leaked down enough to allow the valve to seat. By observing the length of time required by each lifter to leak-down the thickness of the feeler gage, a faulty lifter or lifters can be easily located.

Use the following procedure:

1. Operate engine to allow lifters to fill with oil.

2. Turn off engine. Remove distributor cap and rotate crankshaft so that rotor is at No. 1 firing position.

3. Remove carburetor air cleaner.

4. Disconnect negative battery cable.

5. If car, except 693 Fleetwood Eldorado, is equipped with Air Conditioner, partially remove compressor as described in Section 1, Note 31a.

6. Disconnect spark plug wires at plugs and remove positive ignition coil wiring from tab on left rocker arm cover, but leave wiring connected at positive terminal. On cars, except 693, equipped with A.I.R. system, remove pump filter from left rocker arm cover and set aside with hoses attached.

7. Remove rocker arm covers.

8. If car is equipped with Cruise Control, disconnect accelerator linkage rod at control unit.

9. Check each lifter listed in following table:

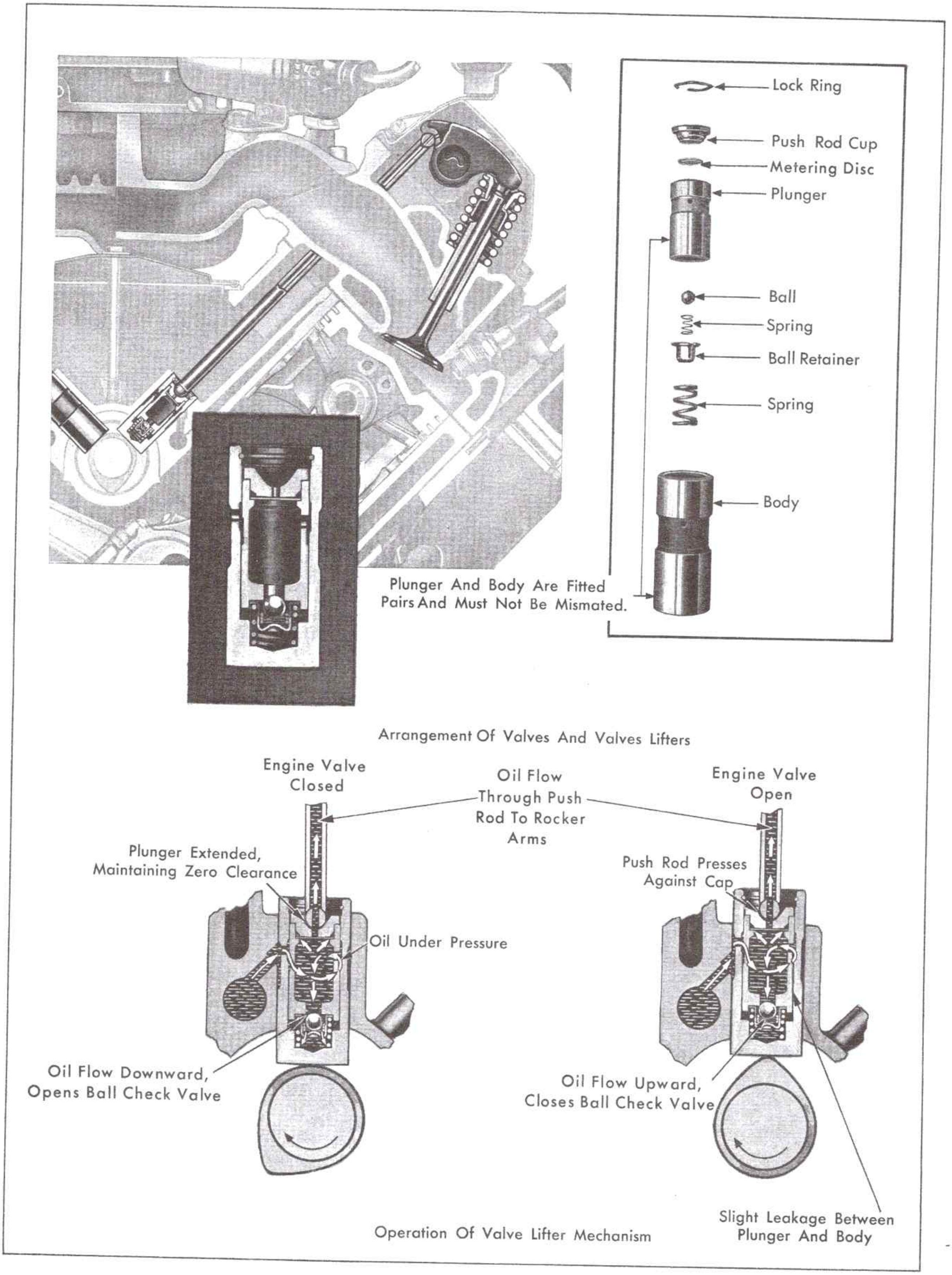


Fig. 6-134 Valve Lifter Mechanism & Operation

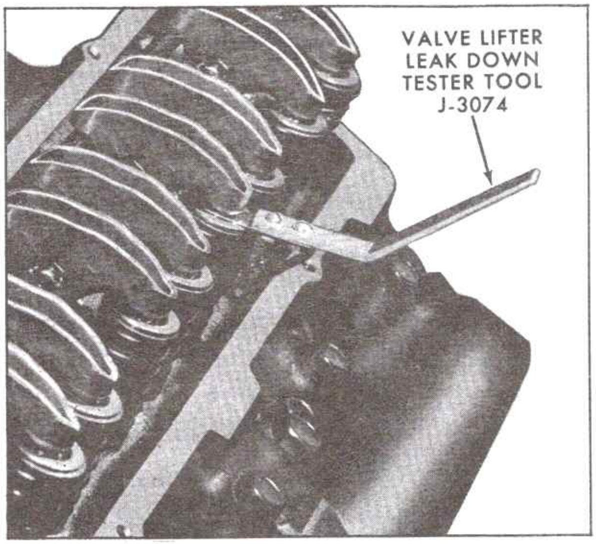


Fig. 6-135 Valve Lifter Leak-Down Rate Checking

Rotor at No. 1 firing position (pointing toward No. 1 cylinder).

Check:

1 Exhaust	2 Exhaust
1 Intake	4 Intake
3 Intake	8 Intake
3 Exhaust	8 Exhaust
5 Intake	
7 Exhaust	

10. Insert feeler gage of tool between valve stem and rocker arm and at the same time, compress tool "pop-out" spring to its stock against valve spring retainer, Fig. 6-135.

NOTE: Install tool as quickly as possible to eliminate any unnecessary lifter leak-down.

11. Note interval of time during which tool is held in place by valve spring pressure. The noisy lifter or lifters will have the shortest leak-down time.

12. Connect negative battery cable, install distributor cap, connect spark plug wires, and operate engine to allow lifters again to fill up with oil.

13. Turn off engine, remove distributor cap and rotate crankshaft so that rotor is at No. 6 firing position. Disconnect spark plug wires and negative battery cable.

14. Check each lifter listed in the following table:

Rotor at No. 6 firing position (pointing toward radiator cap).

Check:

5 Exhaust	2 Intake
7 Intake	4 Exhaust
	6 Exhaust
	6 Intake

15. Install rocker arm covers, using new gaskets, and connect spark plug wires at plugs. Tighten rocker arm cover screws to 28 inch-pounds. Secure ignition coil positive wiring under left rocker arm cover tab. On cars except 693, equipped with A.I.R. system, replace pump filter on left rocker arm cover with hoses attached.

16. If car is equipped with Cruise Control, connect accelerator linkage rod to control unit.

17. Install distributor cap.

NOTE: If car, except 693 Fleetwood Eldorado, is equipped with Air Conditioner, install compressor as described in Section 1, Note 31b.

18. Install carburetor air cleaner.

19. Connect negative battery cable.

20. Operate engine to obtain operating temperature and re-torque rocker arm cover screws to 28 inch-pounds.

118. Valve Lifter Removal and Installation

a. Removal

1. Disconnect negative battery cable.

2. Remove carburetor air cleaner.

3. If car is equipped with Air Conditioner, partially remove compressor as described in Section 1, Note 31a or Note 91a for 693.

4. Remove engine oil dipstick.

5. If car is equipped with Cruise Control, disconnect accelerator linkage rod at control unit.

6. Disconnect spark plug wires at plugs, and disconnect spark plug wiring retainer clips from brackets attached to rocker arm covers.

7. Disconnect high voltage wire at ignition coil and remove distributor cap from distributor.

8. Remove ignition coil positive wiring from left rocker arm cover tab. On cars equipped with A.I.R. system, remove pump filter from left rocker arm cover and set aside with hose attached. Remove rocker arm cover screws and remove rocker arm covers, secondary wiring, and distributor cap as an assembly.

9. Loosen cap screws (four on each side) that hold rocker arm assemblies to cylinder heads and remove push rods through openings in cylinder heads.

10. Remove intake manifold as described in Note 6-109, steps 19 through 33.

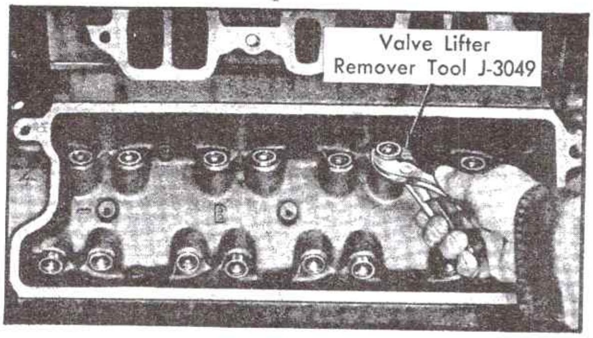


Fig. 6-136 Valve Lifter Removal

11. Remove front and center cap screws that hold valve compartment cover to cylinder block.

12. Remove long screw that holds ventilator valve connector to valve compartment cover and remove connector with hose attached on cars so equipped.

13. Remove valve compartment cover from cylinder block and discard gasket.

14. Using a small screwdriver, or pointed tool, remove lifters from engine, keeping them in order so they can be reinstalled in same bores from which they were removed. Use Valve Lifter Remover, J-3049, to remove any lifters that are stuck, rotating lifter back and forth while lifting, Fig. 6-136.

b. Installation

Before installing valve lifters, apply a small amount of rear axle lubricant to the foot of each lifter.

1. Install lifters in cylinder block in same bores from which they were removed.

2. Install valve lifter compartment cover on cylinder block, using new gasket, and secure with front and center attaching screws. Tighten screws to 25 inch-pounds.

3. Place ventilator valve connector on cars so equipped over opening in valve cover, using new gasket, and secure with long attaching screw. Tighten screw to 25 inch-pounds.

4. Install intake manifold as described in Note 6-115 steps 10 through 26.

5. Install push rods through openings in cylinder heads. Bottoms of push rods must be seated in hydraulic valve lifter cups.

6. Position rocker arm assemblies over push rods so that tops of push rods are seated in rocker arm sockets, and tighten attaching screws (four on each side) to 60 foot-pounds.

7. Recheck torque of all cylinder head cap screws. These should be tightened to 60 foot-pounds.

8. Using new gaskets, install rocker arm covers, secondary wiring, and distributor cap as an assembly.

9. Install cap screws that hold rocker arm covers to cylinder heads and tighten screws to 28 inch-pounds. Position coil positive wiring under tab on left rocker arm cover. On cars equipped with A.I.R. system, replace pump filter on left rocker arm cover with hose attached.

10. Install distributor cap on distributor and connect high voltage wire to ignition coil.

11. Connect spark plug wires at plugs, and connect spark plug wiring retainer clips to brackets attached to rocker arm covers.

12. If car is equipped with Cruise Control, connect accelerator linkage rod at control unit.

13. Install engine oil dipstick.

14. If car is equipped with Air Conditioner, install compressor as described in Section 1, Note 31b or Note 91b for 693.

15. Install carburetor air cleaner.

16. Connect negative battery cable.

17. Operate engine to obtain operating temperature and re-torque rocker arm cover screws to 28 inch-pounds.

119. Valve Lifter Disassembly and Assembly

a. Disassembly

NOTE: Valve plungers and bodies are matched in pairs and are not interchangeable with one another. In order to fit properly, they must be reassembled to their original matching pairs.

1. Press down on center of valve lifter push rod cup.

2. Using a pointed tool, remove lock ring from groove while holding cup down.

3. Invert lifter and slide out push rod cup, metering disk, plunger, ball, small spring, ball retainer and spring.

If plunger is stuck in lifter body, place lifter, push rod end down, in Valve Lifter Plunger Remover, J-4160, Fig. 6-137. Holding tool firmly in hand with thumb over lifter body, strike tool sharply on block of wood or wooden bench until plunger falls out of body.

b. Assembly

1. Place ball on its seat in lower end of plunger while holding plunger upside down. Place small spring on ball.

2. Position ball retainer over small spring over ball and snap into recess in plunger.

3. Place spring over ball retainer.

4. Lower lifter body over plunger assembly on an angle to seat spring.

5. Turn assembly right side up and fill plunger with clean engine oil.

6. Jiggle ball with small piece of wire until oil drains out of plunger into body and trapped air is released from body.

7. Refill plunger with oil, place oil metering disc and push rod cup on plunger, and position lock ring over cup.

8. Press lock ring into groove with Valve Lifter Lock Ring Installer, J-2730, Fig. 6-138.

Fig. 6-137 Removing Stock Plunger from Body

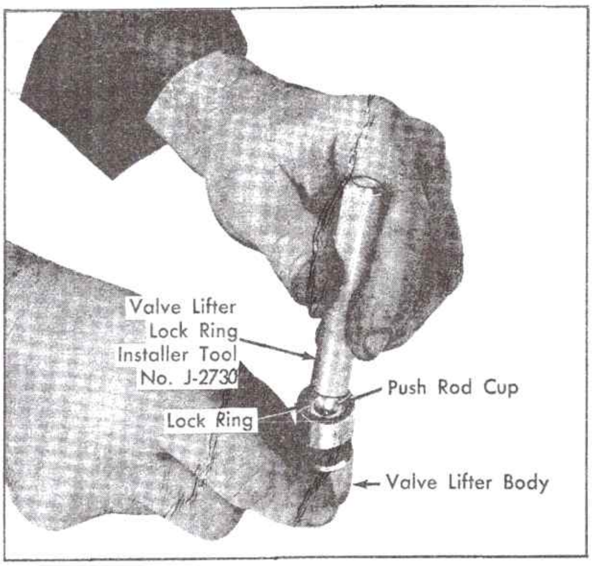


Fig. 6-138 Valve Lifter Lock Ring Installation

120. Engine Oil Pan—Removal and Installation (Except 693)

a. Removal

1. Disconnect negative battery cable.

2. Drain engine oil.

3. Disconnect exhaust "Y" pipe at exhaust manifold as described in Section 8, Note 9a.

4. Disconnect exhaust support bracket at transmission extension housing, and position exhaust system to one side.

5. Remove starter motor as described in Note 6-26a.

6. Remove two idler arm support mounting screws and lockwashers from frame side member, and lower support.

7. Disconnect pitman arm at center link, using Puller, J-8990, and lower steering linkage.

8. Remove transmission lower cover.

9. Remove nuts and cap screws that hold oil pan to cylinder block and engine front cover, and lower oil pan.

10. Remove side gaskets and rubber front and rear seals from oil pan, and discard them.

b. Installation

1. Cement new gasket to both sides of oil pan, lining up holes in gaskets with holes in oil pan flange.

2. Thoroughly clean front and rear seal surfaces of oil pan, and install new oil pan front and rear seals by pulling locating tangs on seals through locating holes in seal flange. Make sure seals are firmly positioned on flange surfaces with ends of each seal properly located in cut-out notches in side gaskets.

3. Seal all four corner notch openings with a coating of rubber cement.

4. Clean out notches in block where ends of oil pan rear seal fit. Fill this rectangular cavity with Transmission Cooler Hose Cement.

NOTE: This cement will be easier to apply if the tube has been stored in a cool location to prevent the contents from becoming too thin.

5. Position oil pan on bottom surface of cylinder block, and install cap screws and nuts tightening to 10 foot-pounds.

6. Tighten cap screws and nuts that secure oil pan to cylinder block to 10 foot-pounds.

7. Install transmission lower cover and secure with four cap screws. Tighten screws to 20 foot-pounds.

8. Connect pitman arm to center link.

9. Secure idler arm support mount to frame with two attaching screws and lockwashers. Tighten screws to 35 foot-pounds.

10. Secure starter motor to cylinder block as described in Note 6-26b.

11. Install exhaust "Y" pipe at exhaust manifold as described in Section 8, Note 9b.

12. Position exhaust support bracket on exhaust pipe and at transmission extension housing, and secure with attaching screws.

13. Add four quarts engine oil to crankcase. Check oil dipstick for proper oil level.

14. Connect negative battery cable.

15. Run engine and check for leaks at all connections.

121. Connecting Rod and Piston—Removal

1. Remove cylinder heads as described in Note 6-109.

2. Clean carbon from top of cylinder bore. Ream upper ridges if necessary to prevent breakage or distortion of piston ring lands due to rings catching in the ridge. Pack cylinder bore with cloth to catch shavings.

3. Remove oil pan as described in Note 6-120 or 6-144.

4. Remove three cap screws that hold oil intake screen assembly to cylinder block and remove intake screen assembly. Discard gasket.

5. Remove connecting rod cap by removing connecting rod nuts and sliding cap down off connecting rod bolts, Fig. 6-139.

6. Install Connecting Rod Guide Set, J-3224, on connecting rod bolts.

CAUTION: Be careful not to damage crankshaft or cylinder bore when removing piston and rod assembly.

7. Push connecting rod and piston assembly up until piston rings are out of bore, and remove piston and connecting rod assembly from engine.

CAUTION: Be careful not to nick lower edge of bore when pushing rod up.

8. Remove remaining seven piston and connecting rod assemblies in same manner.

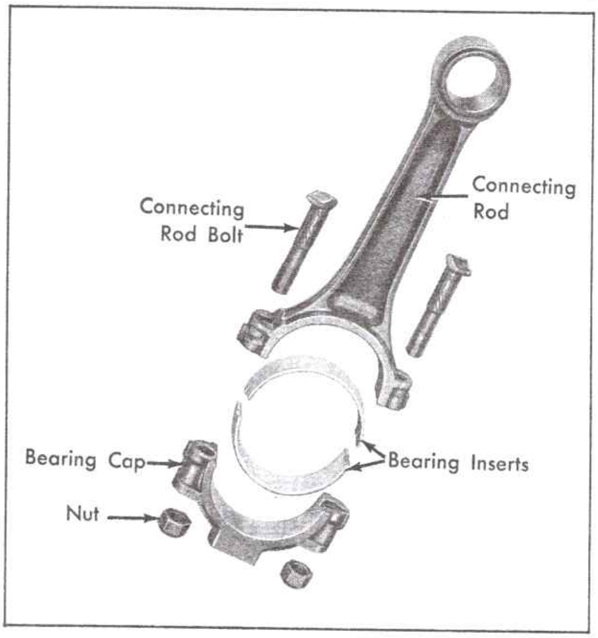


Fig. 6-139 Connecting Rod & Bearing Assembly

122. Connecting Rod Bearing Clearance Checking and Replacement

Worn bearings can be replaced without removing the rod and piston assembly by removing the cap and replacing the upper and lower halves. The clearance between the connecting rod bearing and the crankshaft can be measured by the use of a "Plastigauge", as follows:

1. Remove bearing cap and wipe oil from crankshaft journal and bearing insert.

2. With crankpin at approximate bottom dead center, place a piece of "Plastigauge" in center of cap.

NOTE: When using "Plastigauge", plastic material and part being measured must both be at room temperature. If parts are excessively warm, an incorrect reading may result. Fresh "Plastigauge" is recommended for greatest accuracy.

3. Reinstall bearing cap. Tighten screws to 40 foot-pounds.

NOTE: It is extremely important to position tangs on bearings in notches in rod and cap.

4. Remove bearing cap and determine clearance by comparing width of flattened "Plastigauge", at its widest point, with graduations on "Plastigauge" container. Number within matching graduation on envelope indicates clearance in thousandths of an inch, Fig. 6-140.

If clearance is greater than .0035 inch, replace bearing. If new bearings do not reduce clearance to less than .0035 inch, crankshaft must be replaced to obtain specified limits. If both new bearings and new crankshaft are installed, clearance should be from .0005 inch to .0021 inch.

123. Piston Ring Replacement

Each piston has two compression rings and a side-seal type oil ring that incorporates a stainless steel high tension expander and two chrome plated steel rails. The upper rail is plain and the lower rail is notched on the inside. The top compression ring is molybdenum filled cast iron. The second compression ring is phosphate coated cast iron.

When replacing piston rings, install only rering sets that have molybdenum filled upper compression ring, and multi-piece oil rings.

The compression rings are chamfered on the lower inner face. There is a locating "dimple" on both rings near the end for easy identification of the top side. Install with top side facing up.

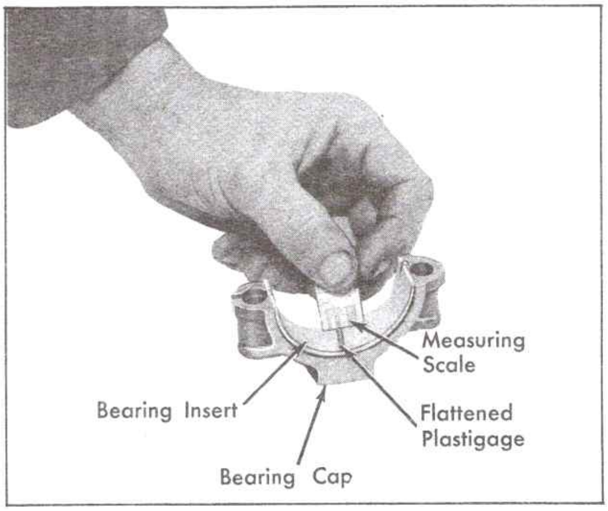


Fig. 6-140 Checking Bearing Clearance

1. Place ring in area of cylinder where piston ring will travel. Be sure ring is square with cylinder bore by positioning ring with piston head.

2. Gap between compression ring ends should be .013 inch to .020 inch.

3. Gap between oil ring ends should be .015 inch to .055 inch.

4. With compression ring on piston, clearance between top surface of piston ring and ring land should be no greater than .005 inch. If clearance is greater, replace the ring. If the new ring does not reduce the clearance to .005 inch or less, new pistons should also be installed.

Clearance on new rings and new pistons should be .0022 inch to .0035 inch. This can be checked with a .002 inch and a .004 inch feeler gage on a "go-no go" basis. The .002 inch feeler gage should always enter; the .004 inch feeler gage should never enter. When installing rings on piston, gaps in piston rings should be staggered by approximately 120°.

124. Piston Pin Removal and Installation

a. Removal

1. Place Piston Pin Support, J-8390-8, on arbor press.

2. Position piston and connecting rod assembly on support with side of piston marked with the letter "R" upward, Fig. 6-141.

3. Insert pilot end of Piston Pin Remover and Installer, J-8390-6, into piston pin and press pin out of piston and rod assembly.

4. Remove assembly from press and remove piston from support.

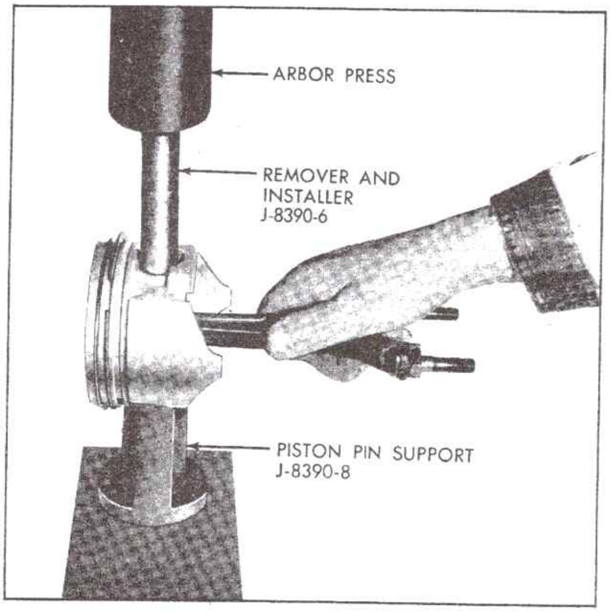


Fig. 6-141 Piston Pin Removal

NOTE: Keep piston pins in order so that they can be installed in the piston from which they were removed.

b. Installation

1. Lubricate piston pin and pin holes in piston with engine oil to facilitate installation.

2. Place Piston Pin Support, J-8390-8, on arbor press with Spring, J-8390-4, and Spacer, J-8390-2, with solid end over spring in position in Support, Fig. 6-142.

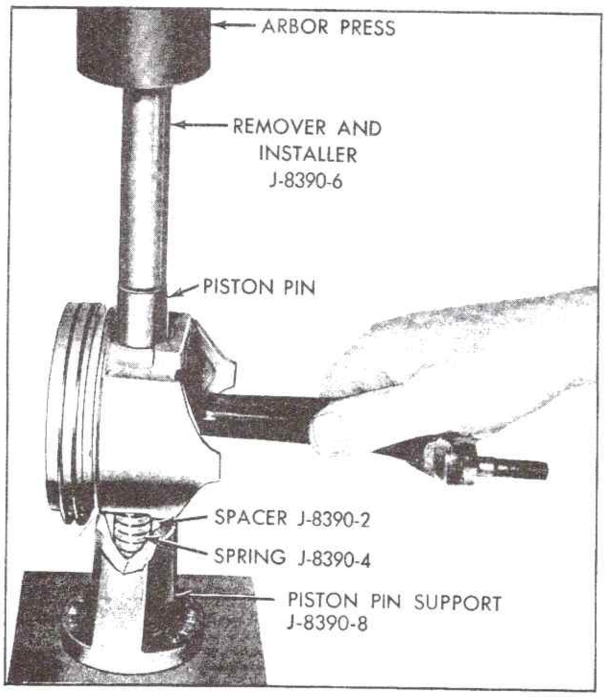


Fig. 6-142 Piston Pin Installation

3. Position connecting rod in its respective piston so that, when assembly is installed in engine, side of piston stamped with the letter "R" is toward rear of the engine and number on lower end of rod is down. (Numbers 1, 3, 5, and 7 are in the left bank, and 2, 4, 6, and 8 are in the right bank.)

4. Position piston with connecting rod on Piston Pin Support, and insert piston pin into position as shown in Fig. 6-142.

5. Place Piston Pin Remover and Installer, J-8390-6, on piston pin and press pin until it bottoms on spacer in support. Remove piston and connecting rod from support. Center pin in piston, this will properly locate the connecting rod on the piston pin and piston.

NOTE: Piston pins are a selective fit to the piston and are not available separately. Piston pins will not wear enough to cause a knock or tapping until after very high mileage, and in such cases, a new piston and pin assembly should be installed.

125. Piston Clearance

When measuring piston diameter, the micrometer should be placed 3/16 inch below the cross slot or 1/4 inch below the oil ring groove, Fig. 6-143. Cylinders must be measured by placing the micrometer 1-1/8 inches from the top, and perpendicular to the centerline of the face.

An identification letter is stamped on the valve lifter compartment cover rail next to the

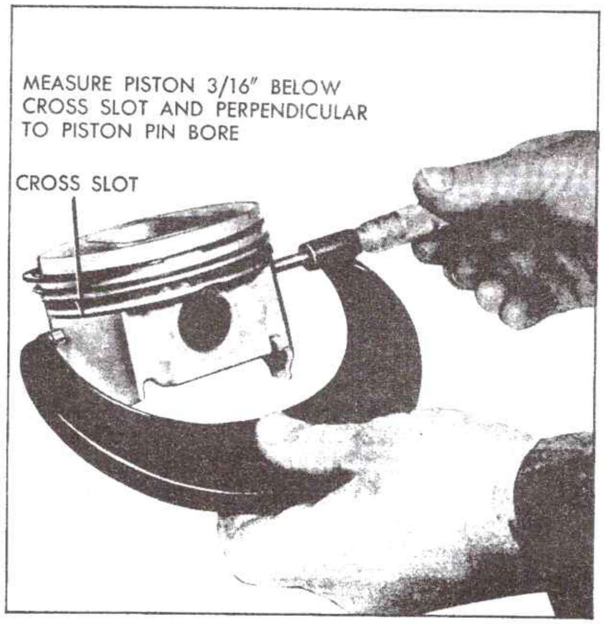


Fig. 6-143 Measuring Piston Diameter

inside edge of the cylinder head. The letters are in groups of two for adjacent cylinders (such as "H" "B") midway between the two cylinders. This letter denotes the cylinder-piston size as shown in the following table:

Letter	Cylinder Size (Diameter in Inches)	Piston Size (Diameter in Inches)
A	4.1290 - 4.1292	4.1282 - 4.1284
B	4.1292 - 4.1294	4.1284 - 4.1286
C	4.1294 - 4.1296	4.1286 - 4.1288
D	4.1296 - 4.1298	4.1288 - 4.1290
E	4.1298 - 4.1300	4.1290 - 4.1292
H	4.1300 - 4.1302	4.1292 - 4.1294
J	4.1302 - 4.1304	4.1294 - 4.1296
K	4.1304 - 4.1306	4.1296 - 4.1298
L	4.1306 - 4.1308	4.1298 - 4.1300
M	4.1308 - 4.1310	4.1300 - 4.1302

The table indicates ten piston sizes ranging in steps of .002 inch from 4.1282 inches to 4.1302 inches. This makes it possible to maintain the .008 to .0012 inch piston to cylinder wall clearance. The sizes shown apply to 70°F.

If double letters (such as "AA", "BB") appear on the cylinder head face of the block just below the cylinder bore, it indicates that the cylinder has been bored to .010 inch over the diameter indicated by a single letter in the chart. For example, a cylinder with the letters "CC" stamped on the block would have a diameter of 4.1394 inches to 4.1396 inches; a matching piston for this size would have a diameter of 4.1386 inches to 4.1388. .

Orders for service pistons after the end of the 1967 model year will be filled in sizes "H, J or K" and "HH, JJ or KK" through the servicing Parts Warehouses. These service pistons are to be ordered only as "standard" or ".0100 inch oversize", they are not supplied by code size.

1967 engine cylinder bores must not be reconditioned to more than .0100 inch oversize as pistons are not available over this range.

While the 1967 model is in production, specific code size pistons "A" through "M" and "AA" through "MM" are available from the factory Parts Warehouse in Detroit on a special order basis.

NOTE: Before special ordering specific code size pistons, it is very important to check the sizes of the cylinder bores by actual measurement. Actual measurement at the time of replacement is the only certain way to avoid error in ordering.

An outside micrometer and an inside micrometer are required to determine piston clearance. The outside micrometer, used for measuring piston diameter, must be adjusted to turn freely so that it can be adjusted up to the piston with a very light turning effort on the screw. If it is adjusted to get a frictional feel over the piston, it will show several tenths of a thousandth smaller than its actual size. With practice, fractional thousandths can be checked accurately.

The inside micrometer for measuring the cylinders may be used with or without an extension handle. It should be adjusted so the screw turns sufficiently tight to retain its setting while checking the cylinder at the different points to be measured.

The direct readings shown on the inside micrometer should not be taken as the cylinder sizes. With one end of the mircometer contacting the cylinder wall and the other being oscillated, adjust the micrometer until it will just slip through the cylinder with a light drag. Remove the micrometer, and measure its length with the outside micrometer, obtaining the same feel as when measuring the piston.

By this method, even if the two micrometers do not agree in readings, no error will result in arriving at the actual clearance of the piston in the cylinder.

126. Connecting Rod Alignment

Connecting rods are carefully aligned at the factory and it is not necessary to check their alignment in the field. Only in cases of damage will they become misaligned. If this condition does exist, the piston, pin and rod assembly should be replaced. Do not attempt to straighten connecting rods.

127. Connecting Rod and Piston—Installation

1. Remove connecting rod cap from connecting rod and install bearing inserts in both cap and rod, being careful to locate bearing tangs in locating notches.

2. Install Connecting Rod Guide Set, J-3224, on rod bolts to protect crankpin journals.

3. Using Piston Ring Compressor, J-22095, position capless rod and piston in cylinder bore with arrow in trough pointing toward front of engine (letter "R" on piston toward rear) Fig. 6-144.

4. Using wood hammer handle, push piston and connecting rod down into position on crankpin and remove Connecting Rod Guide Set, J-3224.

CAUTION: Extreme care must be exercised when installing pistons and rods to be sure rod

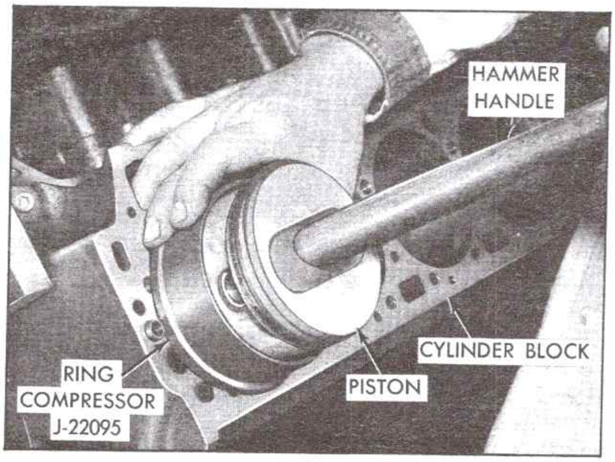


Fig. 6-144 Installing Piston in Cylinder Block

is lined up with crankshaft journal and does not stick or bind on counterweights.

5. Install connecting rod cap and bearing over connecting rod bolts, making sure numbered side of cap is on same side as numbered side of rod.

6. Install remaining seven piston and connecting rod assemblies in the same manner.

NOTE: Recheck to see that numbered sides of connecting rods on Nos. 1, 3, 5, and 7 rods are on left side of engine, and Nos. 2, 4, 6, and 8 are on right side of engine, and that rods are on proper crankpin.

7. Install rod cap nuts and tighten to 40 foot-pounds.

8. Check connecting rod end play on crankpin by tapping the two rods apart at crankpin and checking with feeler gage. An .008 inch feeler gage should always enter space between rod passes at crankpin: a .015 inch feeler gage should never enter.

9. Install oil intake screen assembly on cylinder block, using new gasket and secure with three attaching screws. Tighten screws to 18 foot-pounds.

10. Install oil pan as described in Note 6-120b or 6-144b.

11. Install cylinder heads as described in Note 6-115.

128. Main Bearing Clearance Checking and Replacement

Shell type main bearings of steel-backed aluminum and steel-backed babbitt are used in all 1967 engines. Proper location for these bearings is shown in Fig. 6-145. No. 1 upper and lower bearing halves are interchangeable. No. 2 and 4 upper bearing halves are interchangeable. No. 2 and 4 lower bearing halves are interchangeable. No 3 upper and lower bearing halves are not interchangeable. The crankshaft end thrust is taken by the center main bearing. The worn limit for crankshaft end play is .010 inch.

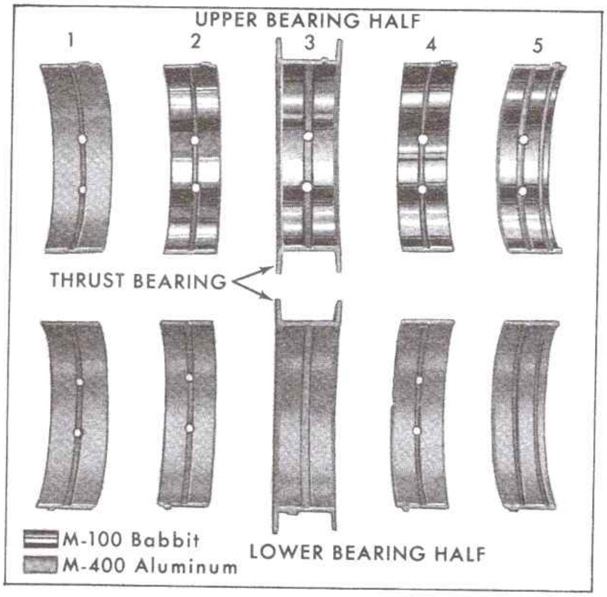


Fig. 6-145 Main Bearing Location

a. To Check a Main Bearing

1. Remove bearing cap as described in Note 128b.

2. Measure bearing wear using the "Plastigauge" Method as described in Note 6-122. Bearing cap must be tightened to 95 foot-pounds.

CAUTION: If bearings are being measured with engine in chassis, crankshaft must be supported in order to take up clearance between upper bearing shell and crankshaft. This can be done by removing bearing caps adjacent to bearing being checked, and placing a strip of .005 inch brass shim stock between lower bearing shell and crankshaft bearing journal. When reinstalling bearing caps, lightly tighten attaching screws to avoid damaging bearing caps.

3. If bearing clearance is greater than .0045 inch, replace bearing.

4. If new bearings do not reduce the clearance to less than .0045 inch, crankshaft should be replaced.

If both new bearings and new crankshaft are installed, clearance should be .0008 inch to .0029 inch for all bearings except front bearing. Clearance for front bearing should be .0005 inch to .0023 inch.

b. Main Bearing Replacement

1. Remove engine oil pan as described in Note 6-120a or 6-144a.

2. Remove three cap screws that hold oil intake screen assembly to cylinder block and remove screen assembly. Discard gasket.

3. Remove spark plugs.

4. Remove two cap screws that hold bearing cap to cylinder block and remove cap. Remove worn shell from cap and discard.

NOTE: Each bearing cap has a number (1, 2, 3, or 4) stamped on the bottom starting from the front. Do not mismatch these caps or turn them around because they are individually matched when the cylinder block is machined.

5. Install Upper Bearing Shell Remover, J-8080, into oil hole in crankshaft bearing journal, Fig. 6-146.

6. Slowly rotate crankshaft clockwise (viewed from front of engine) until tool contacts and forces out upper shell.

7. Install new upper shell in place as far as possible by hand, with locating tang in correct position. Remover, Tool J-8080, may also be used to aid in installing new upper shell. Install tool in crankshaft oil passage so that tool bears against notched end of bearing shell. Rotate crankshaft counterclockwise to position bearing, then remove tool.

8. Install new lower shell in cap with locating tang in correct position.

NOTE: When replacing the rear main bearing, use a new oil seal as described in Note 6-129.

9. Install cap on cylinder block and secure with two attaching screws. Tighten screws to 95 foot-pounds.

10. Replace four remaining bearings in same manner.

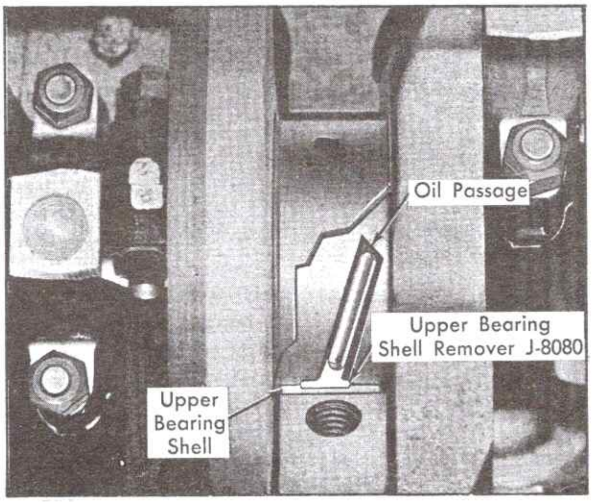


Fig. 6-146 Upper Bearing Shell Removal

NOTE: When replacing center bearing it is necessary to line up bearing thrust surfaces. To do this, install bearing cap screws finger tight. Then, using a plastic hammer, tap crankshaft fore and aft the limit of its travel several times. Do not use hammer on connecting rods, tap on counterweights only.

11. Install spark plugs and tighten to 25 foot-pounds. Connect spark plug wires at plugs.

12. Install oil intake screen assembly on cylinder block, using new gasket, and secure with three attaching screws. Tighten screws to 18 foot-pounds.

13. Install oil pan as described in Note 6-120b or 6-144b.

129. Rear Main Bearing Oil Seal Replacement

Rear main bearing seal installation can be properly accomplished by using a simple, easily made tool, Fig. 6-147. Make the tool out of a metal banding strap or shim stock. The tool will act as a "shoehorn" to protect the backbone or outer diameter of the seal from scraping against the sharp edges of the bearing cap and cylinder block. Replacement procedure is as follows:

1. Raise car and place jack stands under car.

2. Disconnect spark plug wires and remove spark plugs.

3. Remove oil pan as described in Note 6-120a or 144a.

4. Loosen two cap screws that hold rear main bearing cap to cylinder block and remove cap with screws.

5. Remove lower seal half from bearing cap and discard.

6. Rotate upper seal half by pushing on one end with sharp object, and remove upper seal half from cylinder block.

7. Inspect grooves in bearing cap and cylinder block to be sure they are clean, dry and free from burrs.

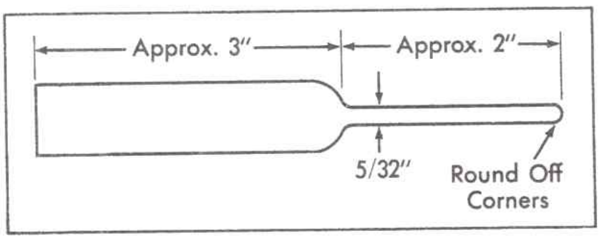


Fig. 6-147 Rear Main Bearing Oil Seal Installer Tool

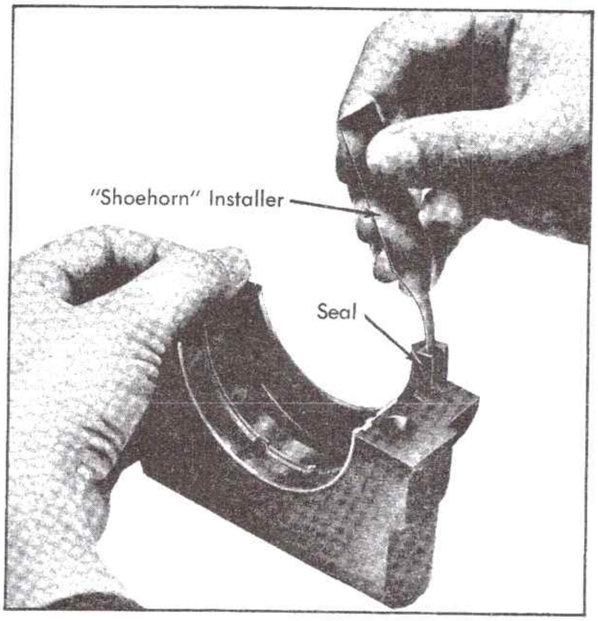


Fig. 6-148 Rear Main Bearing Oil Seal Installation

NOTE: The two seal halves are identical and can be used in either the lower or upper location. Both seal halves are pre-lubricated with a film of wax for break-in. Do not remove or damage this film.

8. To install lower half of seal into the bearing cap, slide either end of seal into position at one end of bearing cap and place tool on seal land at other end of bearing, Fig. 6-148. Make sure the seal is positioned over the bearing ridge and the lip of the seal is facing forward (car position).

9. Hold thumb or finger (left hand shown in Fig. 6-148) over end of seal that is flush with split line to prevent it from slipping upward, and push seal into seated position by applying pressure to the other end.

10. Make sure seal is pressed down firmly and is flush on each side to avoid possibility of a leak at the seal split line. Avoid pressing on lip as damage to sealing edge could result.

11. To install upper half of seal in cylinder block (with crankshaft in car), position "shoehorn" on land of block. Start seal into groove in block with lip facing forward and rotate seal into position, using care not to distort seal.

12. Do not press on lip or sealing edge of seal may be damaged. Also, both ends of seal should be flush at the seal split line to avoid leaks.

13. If necessary, Lubriplate, or its equivalent, may be used to facilitate installation of both lower and upper half of seal. Do not use silicone or an oil leak may result.

14. Prior to assembly of rear main bearing cap on block, apply rubber cement to cap and block. Apply a film approximately .010 inch thick to each surface to act as a sealer.

CAUTION: Keep rubber cement off the seal lip and the bearing surface to avoid damage to the seal and crankshaft.

15. Install bearing cap and secure with attaching screws. Tighten screws to 95 foot-pounds.

16. Rotate crankshaft 360° to make sure crankshaft is not binding.

17. Install oil pan as described in Note 6-120b or 6-144b.

18. Install spark plugs and tighten to 25 foot-pounds. Connect spark plug wires.

19. Run engine and check for oil leaks.

20. Remove stands an lower car.

130. Timing Chain and Sprockets Removal and Installation

a. Removal

1. Remove engine front cover as described in Note 6-104a.

2. Remove two cap screws with lockwashers that hold camshaft sprocket to camshaft.

3. Remove camshaft sprocket, with chain, from camshaft.

4. Remove crankshaft sprocket from crankshaft.

5. Remove Woodruff key from crankshaft key slot.

b. Installation

1. With soft faced hammer, seat Woodruff key in crankshaft key slot.

2. Install crankshaft sprocket on crankshaft, with timing mark toward the front and sprocket key slot lined up with crankshaft key slot.

3. Install camshaft sprocket in timing chain with timing mark toward the front.

4. Place chain over crankshaft sprocket and line up timing marks on both sprockets as shown in Fig. 6-149.

5. Hold camshaft sprocket in position against end of camshaft and press sprocket on camshaft by hand, being sure index hole in camshaft is lined up with index hole in sprocket.

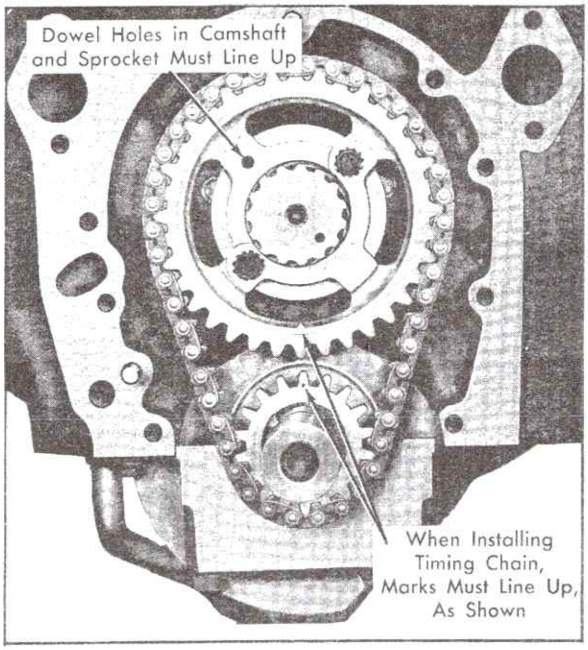


Fig. 6-149 Timing Gear Locating Marks

6. Install two cap screws with lockwashers that hold camshaft sprocket to camshaft. Tighten screws to 18 foot-pounds.

7. Install engine front cover as described in Note 6-104b.

131. Camshaft Removal, Inspection and Installation

a. Removal

1. Remove radiator as described in Section 13, Note 5a.

2. On car equipped with Air Conditioning remove condenser as described in Section 1, Note 57a or 93a.

3. Remove engine front cover as described in Note 6-104a.

4. Remove timing chain and sprockets as described in Note 6-130a.

5. Remove valve lifters as described in Note 6-118a.

6. Slide camshaft forward carefully until it is out of engine.

CAUTION: Extreme care must be exercised to keep cam lobes from scratching camshaft bearings.

b. Inspection

The camshaft on 1967 engines is made of alloy cast iron. It must be handled with particular care to avoid damage.

Whenever camshaft has been removed from engine, or faulty camshaft action is suspected in diagnosing engine conditions, the camshaft lobes should be checked for wear. This may be done visually, with camshaft installed in engine, by removing hydraulic lifters and noting condition of camshaft lobes. Excessive wear, scoring, or flaking of the lifter will usually denote camshaft wear. If excessive camshaft wear, scoring or flaking is apparent, camshaft should be replaced.

For 1967, cam intake and exhaust lobes have a lift of .266 inch. The intake and exhaust lobes are arranged from front to rear in the following order: No. 1 exhaust, No. 2 exhaust, No 1 intake, No. 2 intake, No. 3 intake, No. 4 intake, No. 3 exhaust, No. 4 exhaust, No. 5 exhaust, No. 6 exhaust, No. 5 intake, No. 6 intake, No. 7 intake, No. 8 intake, No. 7 exhaust and No. 8 exhaust.

Bearing journals should not be scored or burned. Cam lobes should be smooth and free of burrs and grooves. Fuel pump eccentric should not show any evidence of wear. If abnormal wear or grooves are noted, camshaft should be replaced. Camshaft bearings should be visually inspected, in their bores, for excessive wear.

c. Installation

NOTE: Before installing camshaft, apply a thin coating of rear axle lubricant to camshaft bearing journals and camshaft lobes.

1. Lower camshaft into position between grille and engine, and guide it carefully into cylinder block.

CAUTION: Extreme care must be exercised to avoid nicking or scratching camshaft bearings.

2. Install valve lifters as described in Note 6-118b.

3. Install timing chain and sprockets as described in Note 6-130b.

4. Install engine front cover as described in Note 6-104b.

NOTE: On cars equipped with Air Conditioning, install condenser as described in Section 1, Note 57b or 93b.

5. Install radiator, as described in Section 13, Note 5b.

132. Camshaft Bearing Removal and Installation

Babbit type camshaft bearings are used on all 1967 engines. These bearings are precision line-bored at the factory, prior to assembly of an engine, and seldom need replacing.

Whenever camshaft has been removed from engine for inspection, these bearings should be visually inspected in their bores for excessive wear. If excessive wear is evident, all five bearings should be replaced. A precision pre-machined camshaft bearing, interchangeable bore to bore, is available for field replacement.

a. Removal

1. Remove radiator as described in Section 13, Note 5a.

2. On cars equipped with Air Conditioning, remove condenser as described in Section 1, Note 57a or 93a.

3. Remove crankshaft as described in Note 6-133a.

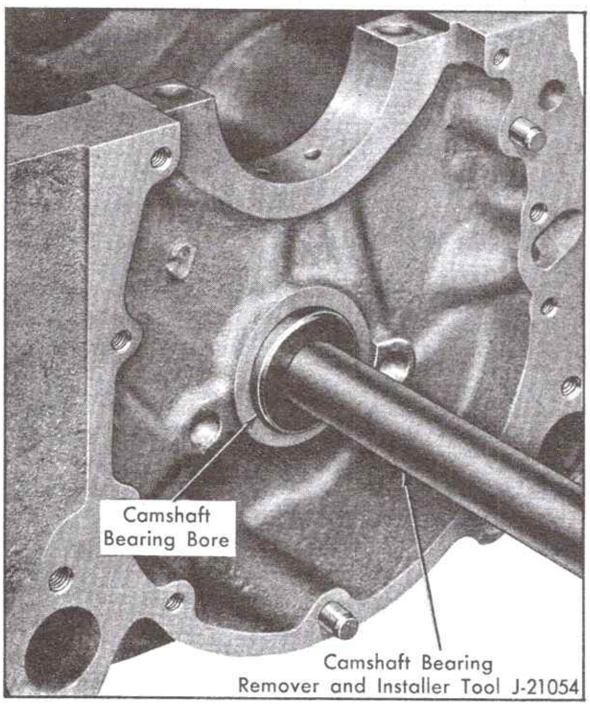


Fig. 6-150 Camshaft Bearing Removal

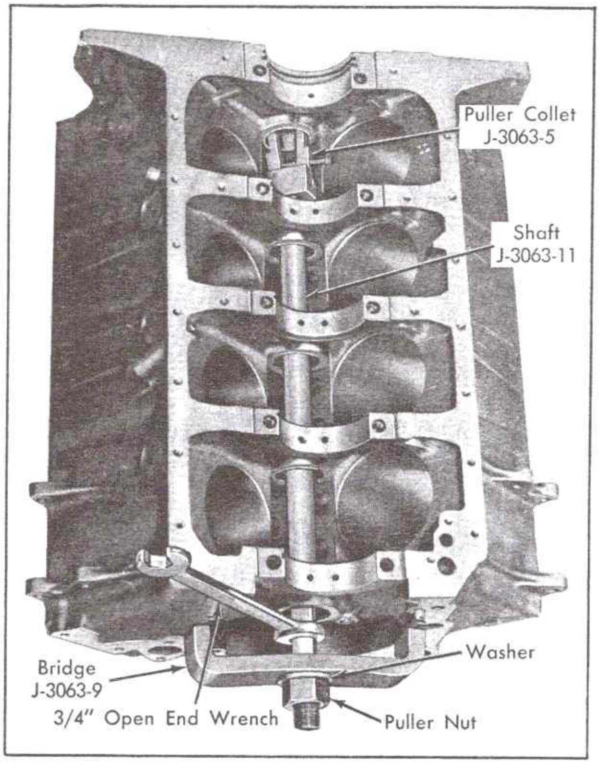


Fig. 6-151 No. 5 Camshaft Bearing Removal

3. Remove crankshaft as described in Note 6-133a.

4. Remove valve lifters as described in Note 6-118a.

5. Slide camshaft forward carefully until it is out of engine.

6. Thread Arbor, J-21054-2, on end of Drive Shaft, J-21054-1, and position shoulder on arbor against front face of No. 1 bearing, Fig. 6-150.

7. Using a hammer, drive No. 1 bearing out through rear face of bearing bore. Remove bearing from arbor and discard.

8. Remove remaining four bearings in same manner. When removing No. 5 bearing, drive out rear welch plug, located behind No. 5 bearing, along with bearing.

NOTE: If Camshaft Bearing Remover and Installer, J-3063, is available, No. 5 bearing can be removed without removing the rear welch plug by following the procedure outlined below:

a. Install Puller Collet, J-3063-5, in No. 5 bearing, Fig. 6-151.

b. Tighten thumb screw and make sure that fingers are securely behind No. 5 bearing.

c. Slide Shaft, J-3063-11, through bearing bores No. 1, 2, 3 and 4, and thread shaft into puller collet in No. 5 bearing.

d. Slide Bridge, J-3063-9, over front of shaft, with legs of bridge toward front face of block.

e. Slide flat washer on front end of shaft and install puller nut.

f. Place a 3/4 inch open end wrench over flattened section of shaft, which is between bridge and block. This keeps shaft from turning during pulling operation.

g. Tighten puller nut until No. 5 bearing is removed.

h. Remove all pieces of the Camshaft Bearing Remover and Installer, J-3063, from cylinder block.

b. Installation

1. If rear welch plug was removed, install new welch plug in rear of No. 5 bearing bore and seal plug with a permanent type sealer.

2. Locate center of oil hole passage in each bearing bore and scribe a reference mark on front face of each bore, Fig. 6-152.

3. Slide Drive Shaft, J-21054-1 with Arbor, J-21054-2 through No. 1, 2, 3, and 4 bearing bores until arbor is positioned between No. 4 and No. 5 bores.

4. Place new bearing on arbor tool and install arbor in No. 5 bearing bore, lining up oil hole in bearing with scribe mark on front face of bore, Fig. 6-153.

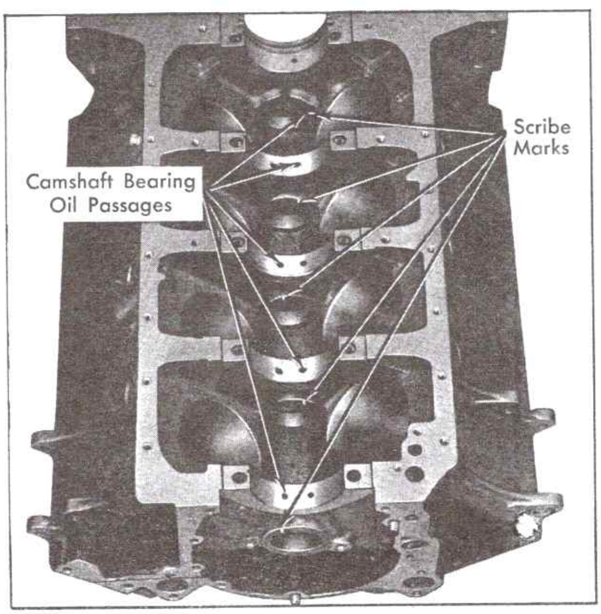


Fig. 6-152 Camshaft Bearing Oil Passages

5. Using a hammer, install bearing in bore until oil hole in bearing is lined up with oil hole passage in bore.

6. Install No. 4, 3, 2 and 1 bearings in the same manner.

7. Lower camshaft into position between radiator grille and engine and guide it carefully into cylinder block.

> NOTE: Before positioning camshaft, apply a coating of rear axle lubricant to camshaft bearing journals and camshaft lobes.

> CAUTION: Extreme care should be exercised to avoid nicking or scratching camshaft bearings.

8. Install valve lifters as described in Note 6-118b.

9. Install crankshaft as described in Note 6-133b.

10. Install radiator, as described in Section 13, Note 5b.

11. On cars equipped with Air Conditioning, install condenser as outlined in Section 1, Note 57b or 93b.

133. Crankshaft Removal and Installation

a. Removal

> NOTE: Engine must be removed from 693 cars as described in Note 6-142a.

1. Raise car and place jack stands under car at all four wheels.

2. Remove timing chain and sprockets as described in Note 6-130a.

3. Remove three cap screws that hold oil intake strainer screen assembly to cylinder block and remove intake screen assembly. Discard gasket.

4. Remove transmission as described in Section 7, Note 13a.

5. Remove six screws that hold flywheel flex plate to crankshaft and remove flex plate from crankshaft.

6. Remove spark plugs.

7. Disconnect connecting rods and push piston assemblies up into cylinder bores so that crankshaft can be removed without interferring with rods.

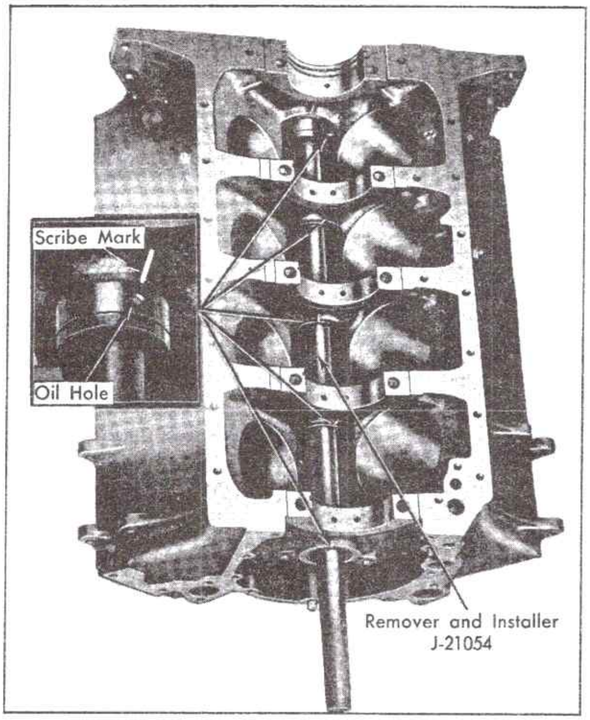


Fig. 6-153 Camshaft Bearing Installation

CAUTION: Use Connecting Rod Guide Set, J-3224, to guard crankpin journals from rod bolts.

8. Remove front and rear main bearing caps.

9. Support crankshaft at front and rear and remove three intermediate bearing caps.

NOTE: Be sure bearing caps are replaced on block in same position and order as removed.

10. Lower crankshaft from engine.

b. Installation

1. Raise crankshaft into position and support in place while installing main bearing caps as described in Note 6-128b. Use a new rear main bearing oil seal as described in Note 6-129.

2. Lubricate crankpins with engine oil and pull connecting rod and piston assemblies down toward crankshaft.

CAUTION: Use Connecting Rod Guide Set, J-3224, to guard crankpin journals from rod bolts.

3. Install connecting rod caps on crankshaft as described in Note 82b.

4. Install oil intake strainer screen assembly on cylinder block, using new gasket, and secure with three attaching screws. Tighten screws to 18 foot-pounds.

5. Install flywheel flex plate and secure with attaching screws. Tighten screws to 75 foot-pounds.

CAUTION: If flex plate and end of crankshaft are marked with an "O", be sure to line these marks up.

6. Install transmission as described in Section 7, Note 13b.

7. Install spark plugs, tighten to 25 foot-pounds, and connect spark plug wires at plugs.

8. Install timing chain and sprockets as described in Note 6-130b.

NOTE: Engine must be installed in 693 cars as described in Note 6-142b.

9. Remove stands and lower car.

134. Engine Removal from Engine Compartment (Except 693)

NOTE: Engine must be removed with transmission attached.

1. Lower radio antenna.

2. Remove hood as described in Section 11, Note 2a.

3. Place car on jack stands, front and rear.

4. Disconnect negative battery cable.

5. Remove carburetor air cleaner.

6. Open drain cock at bottom of radiator and drain radiator and cylinder block. Loosen radiator fill cap so coolant will flow freely.

NOTE: To save coolant, remove radiator filler overflow hose and connect to radiator drain cock.

7. Release hose clamps and disconnect heater hoses at radiator.

8. Disconnect wires from generator.

9. Release the four hose clamps and remove the two radiator hoses.

10. On cars equipped with Air Conditioner, partially remove compressor as described in Section 1, Note 31a.

11. Remove two radiator cradle clamp screws and remove radiator cradle clamps.

12. Disconnect transmission fluid cooler lines at radiator. Plug lines to prevent loss of fluid.

13. Remove radiator from engine compartment.

14. Remove four cap screws that hold fan blade assembly to water pump and remove fan blade assembly, (or hub spacer and fan on non-air conditioned cars), pulley and generator drive belt.

NOTE: Fan clutches used on air conditioned cars are always to be in an "in car position." When removed from car, support assembly to keep clutch disc in a vertical plane to prevent leaks of silicone fluid from clutch mechanism.

15. Remove two power steering pump bracket to cylinder block screws, and position pump and bracket to one side. Do not disconnect power steering hoses.

16. Remove power steering pump belts.

17. Disconnect power brake vacuum hose, and transmission modulator hose at fitting on intake manifold.

NOTE: On cars equipped with Air Conditioning, disconnect vacuum hose from idle speed up control on carburetor.

18. Disconnect throttle return spring and throttle control linkage at carburetor.

19. Disconnect ground strap at frame.

20. Disconnect wires from starter solenoid and detach wires from spring clip.

21. Disconnect battery cable at starter.

22. Disconnect "Y" pipe from exhaust manifolds.

23. Disconnect exhaust support bracket at transmission extension housing.

24. Disconnect "Y" pipe at resonator.

25. Remove "Y" pipe.

26. Remove clevis pin from transmission shift linkage.

27. Remove shift rod clevis pin.

28. Disconnect speedometer gear drive cable at transmission extension housing.

29. Remove two cap screws that hold idler arm support to frame, and position idler arm to one side.

30. Remove two front engine support mount to frame stud nuts.

31. Disconnect propeller shaft as described in Section 4, Note 28a or 29a.

32. Place jack with wood block cushion under transmission and take load from engine rear support cross member.

33. Remove two engine rear support mount to transmission extension housing screws.

34. Remove four bolts (two each side) that hold engine rear support cross member to frame.

35. Remove engine rear support cross member.

36. Position hoist over engine.

37. Pass cable (with looped ends) under intake manifold and hook loops to hoist. Take tension on cable and remove jack from under transmission.

38. Disconnect downshift wire at transmission housing. Disconnect ground straps at cowl. Disconnect all remaining wires and straps.

39. Disconnect fuel feed lines at fuel pump.

40. On cars equipped with A.I.R. system, place scribe marks on pulley and spacer for correct re-installation. Remove six screws that hold crankshaft pulley to harmonic balancer and remove crankshaft pulley. Remove four cap screws that hold air pump pulley to air pump pulley hub and remove pulley. Remove pump filter from left rocker arm cover and set aside with hoses attached.

41. Remove two screws at firewall bracket and four screws at wheel housings and remove engine compartment struts.

42. On cars equipped with Cruise Control, remove cotter pin securing accelerator linkage to exterior arm and remove washer and separate linkage from exterior arm.

43. Tilt rear of engine down at 45° angle and lift engine and transmission straight out.

135. Engine Removal from Transmission (Except 693)

a. Removal

1. Using hoist or jacks, support engine and transmission so that each will be supported separately when removal is accomplished.

2. Disconnect transmission oil cooler lines at transmission. Remove cooler lines.

3. Remove starter motor as described in Note 6-26a.

4. Remove two cap screws that hold cylinder block to transmission housing support brace, and remove support brace.

5. Remove four cap screws that hold transmission lower front cover to transmission housing, and remove lower front cover.

6. Remove three converter to flex plate attaching screws.

NOTE: This is done by inserting a heavy screwdriver in open slot under one of the weld nuts on the converter, and rotating the converter and flex plate until screws can be reached for removal. Do not pry on flex plate ring gear to rotate converter, as flex plate may become damaged.

7. Disconnect vacuum modulator line at modulator.

8. Remove six cap screws that hold transmission housing to cylinder block.

9. Separate transmission from cylinder block.

b. Installation

1. Position transmission housing on cylinder block, lining up locating dowels on engine with dowel holes in transmission housing, and install six transmission housing to cylinder block cap screws. Tighten cap screws to 50 foot-pounds.

2. Connect vacuum modulator line to modulator.

3. Rotate converter to align weld nuts with screw holes in flex plate, and slide converter forward until weld nuts are flush with flex plate. Make certain that converter is not cocked and that pilot on center of converter is properly seated in end of crankshaft. Tighten screws to 25 foot-pounds.

CAUTION: Any deviation from this procedure may result in improper installation and damage to flex plate and transmission. It is important that converter be properly aligned with flex plate so that there is no possibility of draw-up when attaching bolts are installed. If draw-up occurs, converter will become mispositioned, resulting in damage to flex plate and transmission.

4. Install transmission lower front cover and secure with four cap screws.

5. Install cylinder block to transmission housing support bracket, and secure with two cap screws. Tighten cap screws to 50 foot-pounds.

6. Install starter motor as described in Note 6-26b.

7. Install transmission cooler lines at transmission.

136. Engine Installation (Except 693)

1. Tilt rear of engine down at 45° angle and lower into engine compartment.

2. Level engine and transmission and place jack with wood block cushion under transmission and position transmission high enough to install engine rear support cross member.

3. Install engine rear support cross member and secure to engine rear support mount with four attaching bolts. Tighten bolts to 50 foot-pounds.

4. Slacken hoist and remove hoisting cable from intake manifold. Position hoist to one side.

5. Install two rear engine support mount to transmission extension housing screws. Tighten to 55 foot-pounds.

6. Remove jack from under transmission.

7. Connect propeller shaft as described in Section 4, Note 28b or 29b.

8. Install two engine front support mount to frame stud nuts. Tighten nuts to 60 foot-pounds.

9. Position idler arm support at frame side rail and secure with two cap screws.

10. Connect speedometer gear drive cable at transmission extension housing.

NOTE: On cars equipped with A.I.R. system, install crankshaft pulley and spacer. Lining up scribe marks on spacer, pulley and harmonic balancer, secure pulley with six attaching screws. Tighten screws to 15 foot-pounds. Install air pump pulley on air pump pulley hub and secure with four attaching screws. Tighten screws to 18 foot-pounds. Install pump drive belt and adjust as described in Note 6-138b, step 8. Replace pump filter on left rocker arm cover with hose attached.

11. Connect transmission downshift wire at transmission housing.

12. Connect transmission shift rod linkage and secure with clevis pins.

13. Connect transmission downshift switch.

14. Install exhaust "Y" pipe at resonator and secure with U-bolt clamp.

15. Connect exhaust support bracket at transmission extension housing.

16. Connect "Y" pipe at exhaust manifold.

17. Connect battery cable at starter.

18. Connect starter solenoid wires and install wire retaining clip.

19. Connect ground straps at frame and cowl.

20. Connect throttle return spring and throttle control linkage at carburetor.

NOTE: On cars equipped with Air Conditioner, install compressor as described in Section 1, Note 31b, and connect vacuum hose to idle speed-up control on carburetor.

21. Connect power brake vacuum hose to fitting at rear of manifold.

22. Install pulley, and fan blade assembly, or hub spacer and fan on non-air conditioned cars, on water pump and secure with four attaching screws. Tighten screws to 18 foot-pounds.

23. Install radiator and radiator cradle clamps. Tighten clamp screws to 15 foot-pounds.

24. Install generator and power steering pump drive belts.

25. Install power steering pump and bracket on cylinder block and secure with two attaching screws.

26. Install upper and lower radiator hoses and secure with four hose clamps.

27. Connect fuel feed line at fuel pump.

28. Connect generator wires.

29. Connect heater hoses at radiator. Connect transmission fluid cooler lines at radiator.

30. Fill radiator with coolant.

31. Install carburetor air cleaner.

32. Install two engine compartment struts at bracket on firewall and on left and right dust shields. Secure with six attaching screws. Tighten screws to 30 foot-pounds.

33. On cars equipped with Cruise Control, connect accelerator linkage to exterior arm and secure with cotter pin.

34. Check all wiring for loose connections.

35. Connect negative battery cable.

36. Remove jack stands and lower car.

37. Install hood as described in Section 11, Note 2b.

38. Run engine and check all connections for leaks.

137. Engine Support Mountings (Except 693)

Three engine supports are used to mount the engines on all 1967 Cadillac cars. The front support mountings are located on each side of the cylinder block forward, and the rear support mounting is beneath the transmission extension housing.

The front support mountings are seated at an angle directly on the main front cross member of the frame and secured by studs. The rear support mounting at the transmission extension housing rests on a supporting cross member which is secured to the frame. All engine support mountings have rubber cushions to absorb vibrations and road shock.

It is important, when attaching the engine mountings to engine, transmission and frame, that the nuts and screws be tightened to the proper torque as follows:

Nut - Front Support Mount to Cylinder Block - 30 Foot-Pounds

Nut - Rear Engine Support Cross Member to Frame - 20 Foot-Pounds

Screw - Rear Support Mount to Rear Support Cross Member - 50 Foot-Pounds

Screw - Rear Support Mount to Transmission - 50 Foot-Pounds

Stud - Front Support Mount to Frame - 60 Foot-Pounds

Check at all three engine support mounting locations to be sure that no metal-to-metal grounding can occur.

138. Air Pump Removal and Installation

a. Removal

1. Raise hood and, working under hood, remove two screws that hold windshield washer solvent bottle to left dust shield, and position solvent bottle to one side.

2. Remove clamps and hoses from right and left air manifold check valves and from intake air filter.

3. Remove nut and washer from bolt on top of pump that holds pump to front and rear mounting bracket. Slide bolt out of brackets.

4. Raise front end of car and place on jack stands.

5. Working under car, remove corded rubber baffle from left side of frame and cross member.

6. Remove four cap screws attaching air pump drive pulley and remove pulley and belt.

7. Remove nut and washers from bolt that holds bottom of pump to bottom of pump front mounting bracket. Slide bolt rearward out of bracket.

8. Position pump to release hose clamp that holds left air delivery hose to fitting at rear of pump and, holding pump with one hand, remove hose.

9. Release hose clamp that holds intake air hose to one inch fitting at rear of pump and disconnect hose.

10. Release hose clamp that holds right air delivery hose to lower 3/4 inch fitting at rear of pump and disconnect hose.

11. Tilt pump and rotate until pump can be removed.

b. Installation

1. Position pump near pump mounting brackets.

2. Attach left air manifold delivery hose to uppermost 3/4 inch fitting at rear of pump and secure with hose clamp.

3. Attach right air manifold delivery hose to 3/4 inch fitting and secure with hose clamp.

4. Attach air intake hose to one inch fitting at rear of pump and secure with hose clamp.

5. Position pump and slide bolt forward to attach bottom of pump to bottom of pump front mounting bracket, and install washers and nut.

6. Install bolt attaching top of pump to front and rear mounting brackets and attach washer and nut.

7. Attach air pump drive pulley with four cap screws and tighten each to 18 foot-pounds.

8. Install air pump drive belt, adjusting tension to 60 pounds. Tighten upper and lower air pump bolt mounting nuts to 15 foot-pounds.

9. Attach corded rubber baffle to left side of frame and cross member.

10. Attach hoses with clamp to right and left air manifold check valves and to intake air filter.

11. Attach windshield washer solvent bottle to left dustshield with two screws.

12. Remove jack stands and lower car.

139. Air Pump Disassembly and Assembly (Figs. 6-154 and 6-155)

Carbon seals, vane and vane bearings, vane shoes and springs, Fig. 6-154, are available from the Cadillac servicing Parts Warehouse. If pump housing is damaged, pump must be replaced as an assembly.

a. Disassembly

1. Remove four screws that hold pulley to hub and remove pulley.

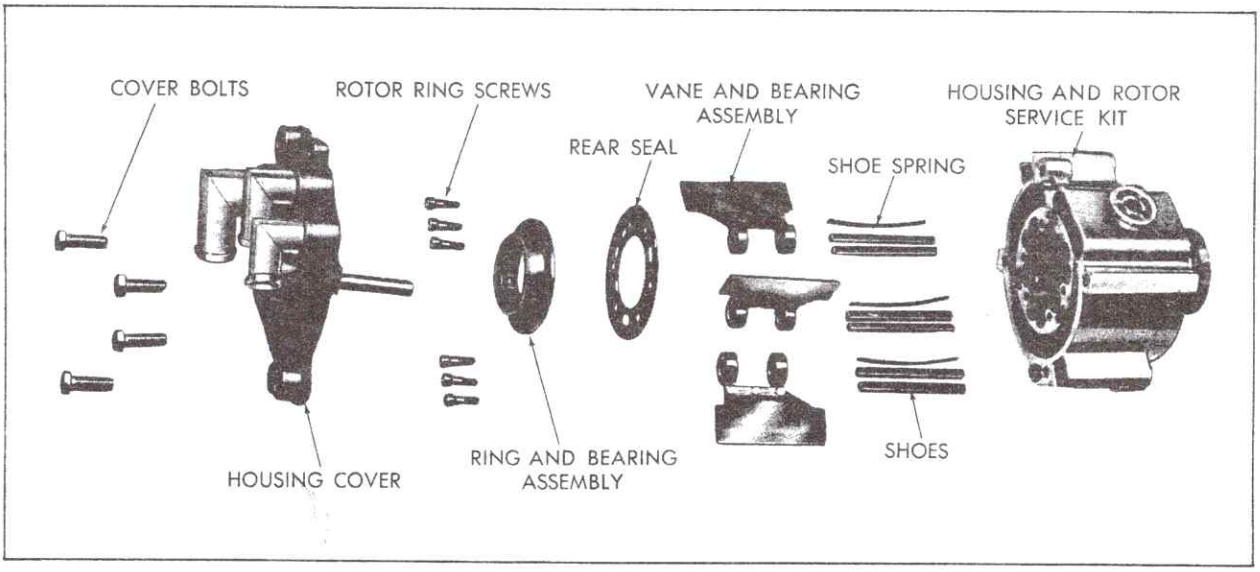


Fig. 6-154 A.I.R. Pump Disassembled

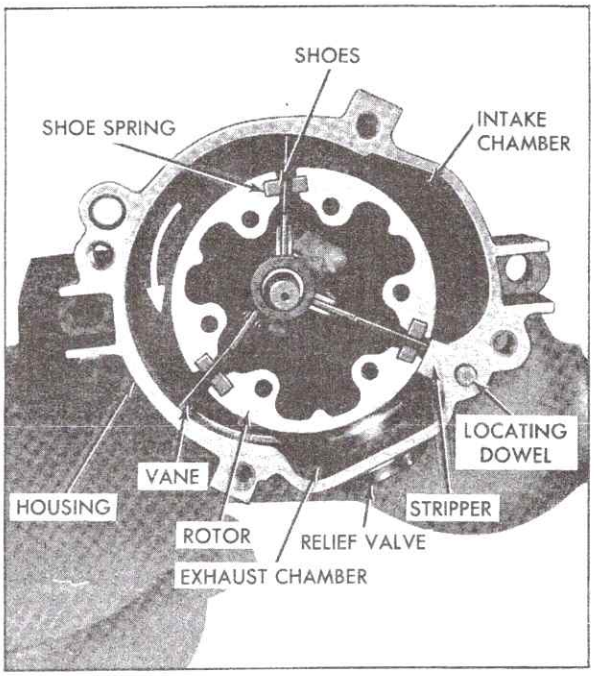


Fig. 6-155 Rear of Pump, Cover Assembly Removed

2. Place pump in vise with pulley hub in vise jaws, Fig. 6-156.

CAUTION: Do not clamp on pump housing as distortion may result. If pump housing is distorted, replace pump.

3. Remove four housing cover assembly screws.

4. Remove housing cover assembly by tapping gently with non-metallic hammer on the boss of the large dowel pin and pulling straight up.

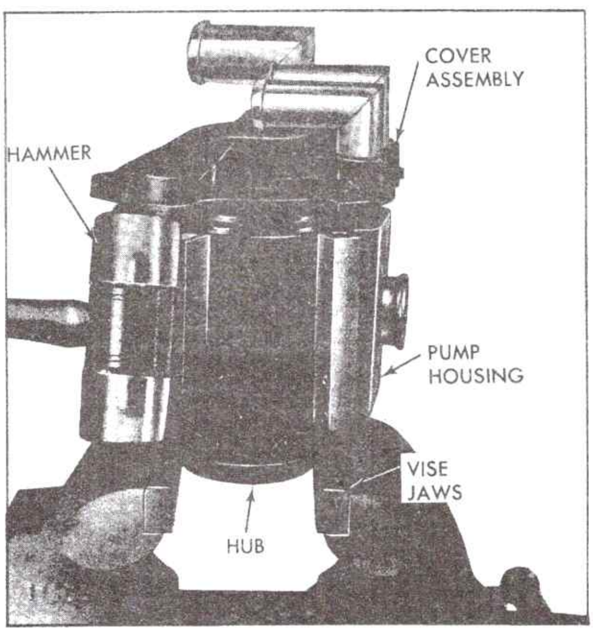


Fig. 6-156 Removing Pump Assembly, Cover in Vise

5. Using hex head wrench, remove six screws that secure rotor ring and bearing assembly to rotor. With a scribe, mark location of ring on rotor. Remove rotor ring and bearing assembly. Discard rear carbon seal if damaged.

To remove rear bearing from rotor ring, place ring and bearing on arbor press. With front cover oil seal installer support, J-21150-2, and 1-1/4 inch socket, press bearing out, Fig. 6-157.

6. Use pencil or 3/8 inch drill rod to keep vanes aligned and remove vanes from rotor, Fig. 6-158.

7. Carefully remove six carbon shoes and three shoe springs.

b. Assembly

NOTE: All pump bearings should be lubricated with Air Injection Reactor pump lubricant especially formulated for the very high temperatures encountered. Work this lubricant well into all pump bearings and carefully wipe away excess.

1. Using pencil or 3/8 inch drill rod to position vanes, install vanes in rotor, Fig. 6-158.

2. Install carbon shoes, "V" opening toward center of rotor.

3. Insert shoe spring behind driven shoes with bow toward shoe, Fig. 6-159.

4. Position rear carbon seal.

5. If rear bearing was removed, install new bearing in rotor ring using arbor press, front

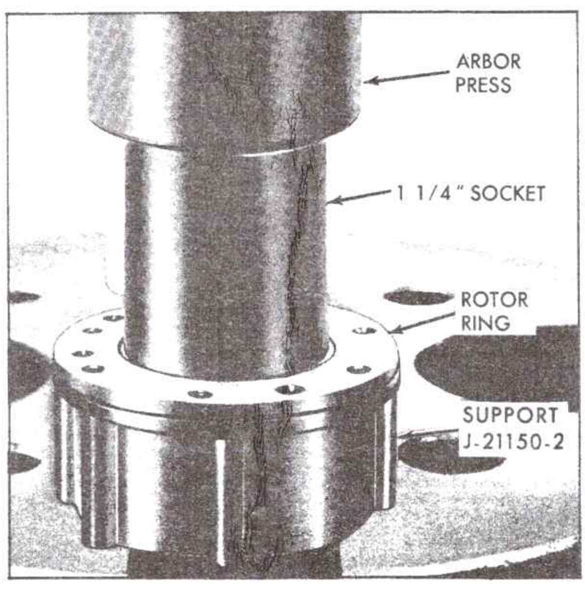


Fig. 6-157 Removing Rear Bearing from Rotor Ring

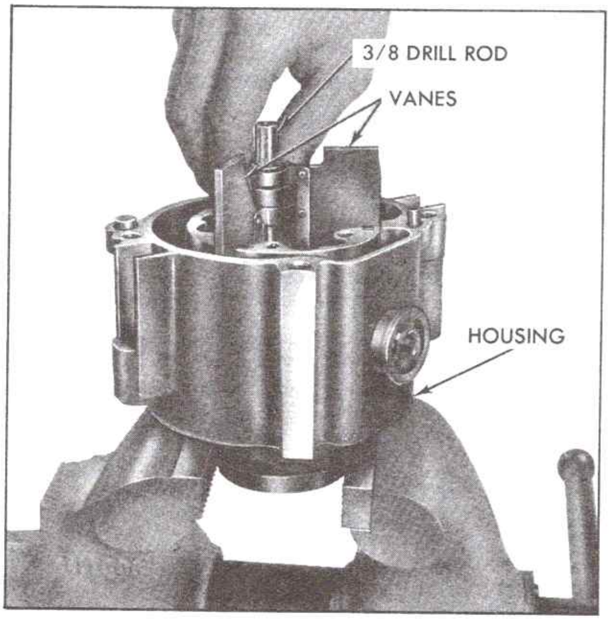


Fig. 6-158 Positioning Vanes and Vane Bearings

cover oil seal Installer Support, J-21150-3, and 1-1/4 inch socket. Press only on lettered end of bearing, Fig. 6-160. Press bearing just below rotor ring flange. Check with straight edge to be sure bearing surface is below flange.

6. Install rotor ring and bearing assembly on rotor and secure with six attaching screws. Tighten screws to 37 inch-pounds. Remove pencil or drill rod from vane bearings.

7. Install housing cover assembly by inserting pivot pin into vane bearings and pressing cover down over locating dowels. Secure cover with four attaching screws. Tighten screws to 12

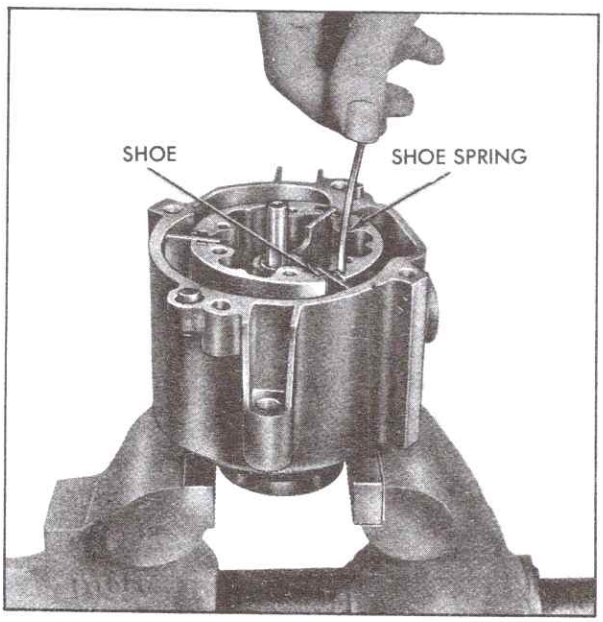


Fig. 6-159 Installing Shoe Springs

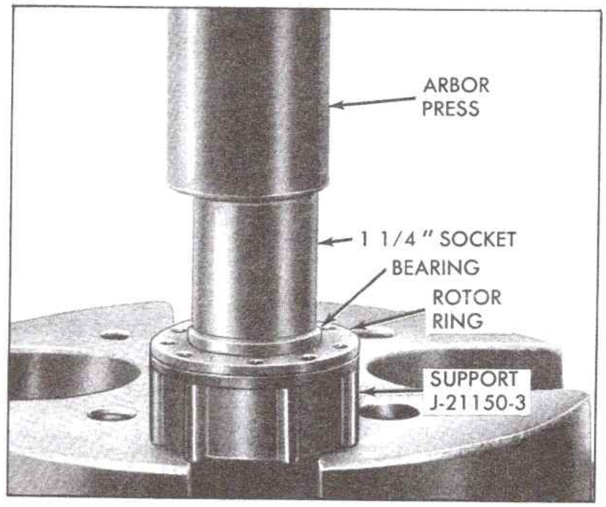


Fig. 6-160 Installing Rear Bearing in Rotor Ring

foot-pounds, torquing down the cover bolt adjacent to the large dowel pin first. This is extremely important to prevent pump damage.

CAUTION: Do not force cover on, as vane bearings or vane bearing alignment might become distorted.

8. Remove pump from vise.

9. Install pulley on hub and secure with four attaching screws. Tighten screws to 18 foot-pounds.

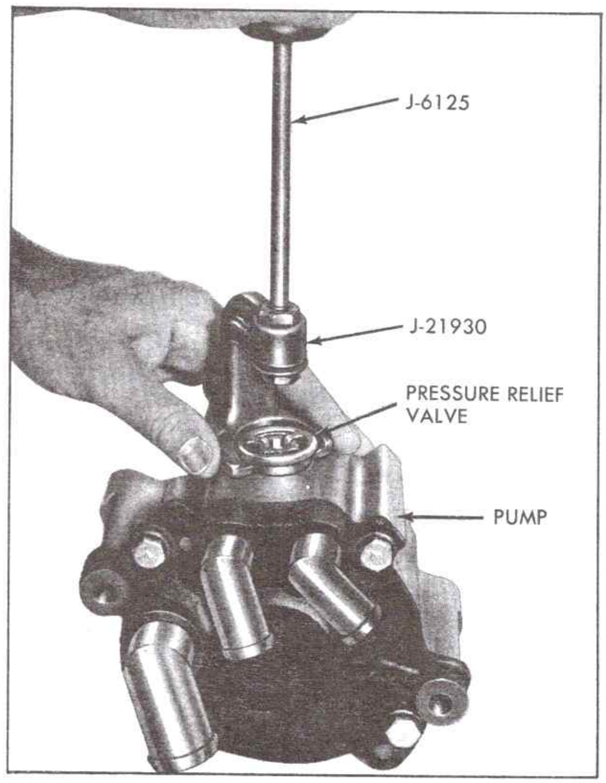


Fig. 6-161 Removing Pressure Relief Valve

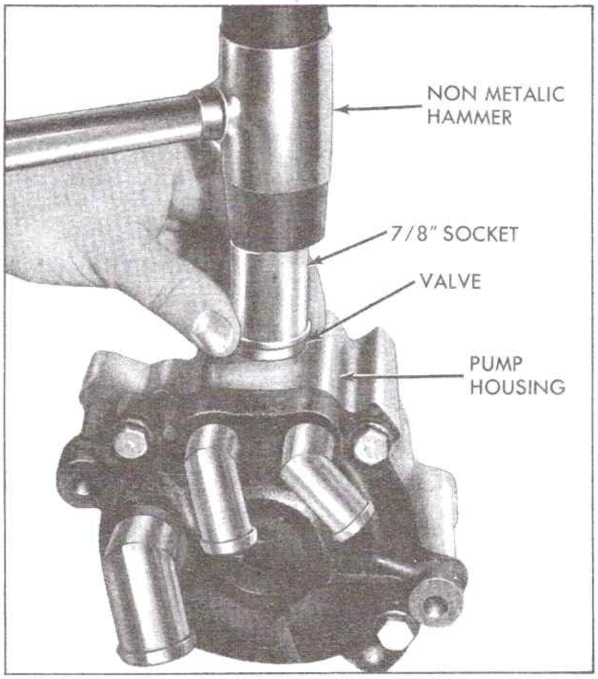


Fig. 6-162 Installing Pressure Relief Valve

c. Pressure Relief Valve Replacement

Pressure relief valve must be removed and installed with pump assembled to avoid distortion of pump housing.

1. Insert Tie Rod End Puller (less bolt), J-21930, under flange of valve. Install Slide Hammer, J-6125, on puller. Drive hammer until valve is free, Fig. 6-161.

2. Position new valve in bore in pump housing and seat with 7/8 inch socket and non-metallic hammer, Fig. 6-162. Seat valve so that shoulder rests on outer surface of pump housing. Valve should protrude 3/8 inch, Fig. 6-163.

140. Air Injection Manifold Removal and Installation

a. Removal

1. Release hose clamp and disconnect air delivery hose at check valve. On left side, remove "S" clip that positions air delivery hose away from manifold.

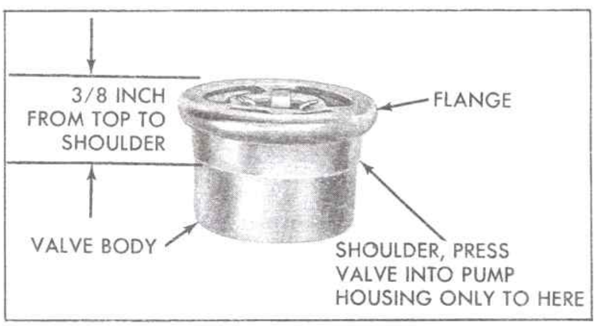


Fig. 6-163 Pressure Relief Valve

2. Remove cap screws that secure two spring clamps to rocker arm cover flange.

3. Withdraw air manifold legs from cylinder head.

NOTE: If packing glands do not come out with legs, a small diameter wire bent to form a hook may be used to remove glands.

b. Installation

1. Install new packing glands on all legs of air manifold and insert air manifold into drilled holes in cylinder head until glands bottom on counterbore.

CAUTION: Legs of air manifold are slip fit into holes. Do not force entry.

2. Secure two spring clamps to rocker arm cover with cap screws. Tighten screws to 28 inch pounds.

3. Connect air delivery hose to check valve fitting and secure with hose clamp. On left side, position air delivery hose and install "S" clip on hose and manifold.

141. Intake Air Bleed Valve Removal and Installation

a. Removal

1. Remove carburetor air cleaner.

2. Disconnect small vacuum sensing hose from bleed valve.

3. Remove bolt and washer that secure valve bracket to rear of intake manifold.

4. Remove valve and mounting bracket by detaching short air hose between carburetor and valve with air supply hose from check valve attached.

5. Release ring clamp and disconnect air hose from valve.

6. Remove mounting bracket from valve.

b. Installation

1. Position valve on bracket and secure with two cap screws.

2. Connect air delivery hose to bleed valve and secure with clamp.

3. Connect air bleed hose to fitting at rear of carburetor and to bleed valve.

4. Bolt valve bracket in place on rear of intake manifold.

5. Connect small vacuum sensing hose to bleed valve.

6. Install carburetor air cleaner.

AIR PUMP DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive Belt Noise	Seized pump.	Remove and disassemble pump, replace part or pump as necessary.
	Loose belt.	Tighten belt.
Excessive Pump Noise, Chirping, Rumbling or Knocking	Leak in hose.	Locate source of leak and correct.
	Loose hose.	Reassemble and replace or tighten hose clamp.
	Hose touching other engine parts.	Adjust hose position.
	Relief valve failure.	Replace valve.
	Vane bearing failure.	Replace vane and bearing assembly.
	Worn rotor.	Replace pump.
	Rear bearing failure.	Replace rear bearing.
	Carbon seal failure.	Replace carbon seal.
	Carbon shoe failure.	Replace shoe.
	Pump mounting fasteners loose.	Retorque all mounting screws.
	Pump housing distorted.	Replace pump.
No Air Supply	Loose belt.	Tighten belt.
	Leak in hose.	Locate source of leak and correct.
	Leak at hose fitting.	Reassemble and replace or tighten hose clamp.
	Vane failure.	Replace vane.
	Carbon shoe failure.	Replace shoe.
	Carbon seal failure.	Replace seal.
	Collapsed intake air hose.	Replace hose.

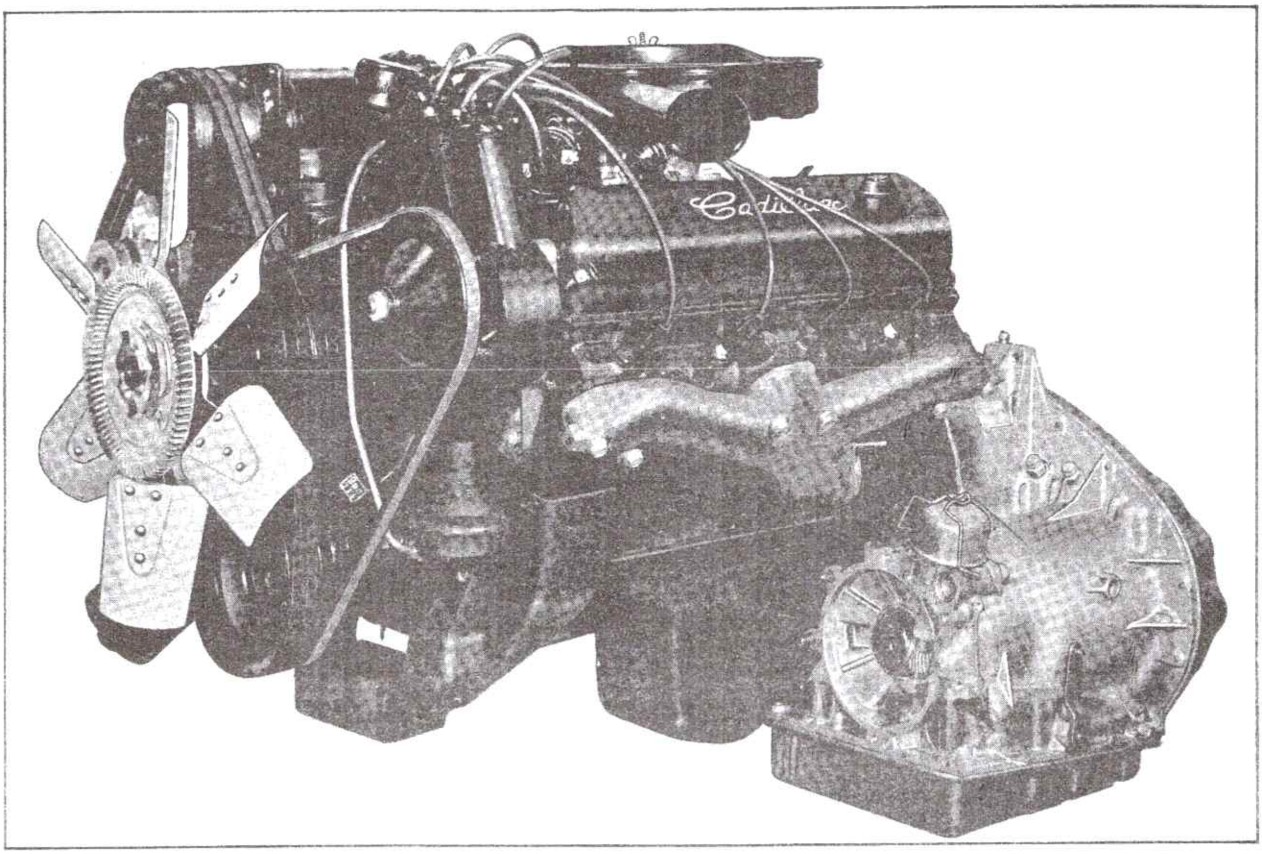


Fig. 6-164 693 Engine 3/4 View with Transmission

142. 693 Fleetwood Eldorado Engine (Figs. 6-164 & 165) Removal and Installation

a. Removal

1. Disconnect negative battery cable.

2. Remove hood as described in Section 11, Note 2a.

3. Remove two nuts holding each cowl rod at wheel well and pivot rods up from cowl.

4. Remove air cleaner.

5. Open drain cock at bottom of radiator and drain radiator and cylinder block. Loosen radiator filler cap so coolant will flow freely.

6. Disconnect wires from generator.

7. On cars equipped with Automatic Climate Control, partially remove compressor as described in Section 1, Note 91a.

8. Disconnect transmission cooler line at left front of final drive by removing screw securing attaching clip.

9. Release two hose clamps and disconnect heater hoses at engine.

10. Disconnect heater hose at water control valve.

11. Remove left and right fan shrouds by removing four screws that secure each fan shroud.

12. Remove four screws securing fan assembly to water pump pulley and remove as an assembly.

NOTE: Fan clutches used on air conditioned cars are always to be in an "in car position." When removed from car, support assembly to keep clutch disc in a vertical plane to prevent leakage of silicone fluid from clutch mechanism.

13. On cars equipped with Automatic Climate Control, disconnect vapor return line near fuel pump and remove clamp securing vacuum hoses to steel vapor return.

14. On cars equipped with A.I.R. system, remove air pump as described in Note 6-138a.

15. Disconnect fuel inlet line at fuel pump. Plug end of line to prevent loss of fuel.

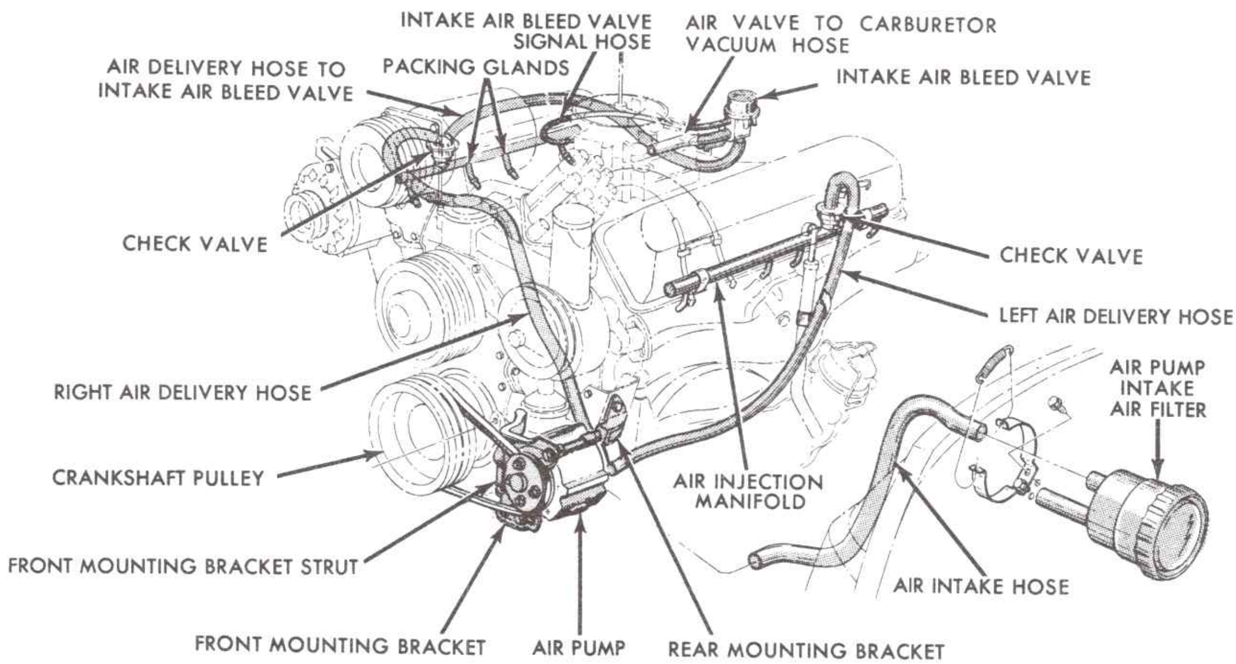


Fig. 6-165 693 Air Injection Reactor System

16. Remove three power steering pump bracket to cylinder block screws, and position pump and bracket to one side. Remove pump belt. Do not disconnect power steering hoses.

17. Disconnect accelerator linkage at carburetor.

18. Disconnect wiring connectors at transmission downshift switch.

19. Disconnect positive terminal wiring at coil and remove wiring harness from two retaining clips on left valve cover.

20. If car is equipped with Cruise Control, disconnect wiring connector at power unit. Remove cotter pin securing accelerator linkage to exterior arm, remove washer and separate linkage from exterior arm. Also disconnect two cables at power unit.

21. Disconnect oil pressure switch connector at rear of engine.

22. Disconnect all vacuum hoses leading from intake manifold and carburetor.

23. Remove two nuts that secure left exhaust clamp to exhaust manifold and disconnect pipe.

24. Remove four upper transmission to adapter screws.

25. Remove right output shaft as described in Section 3, Note 38a.

26. Disconnect starter motor retainer clamps by removing one screw at bearing support and one screw at engine mounting bracket.

27. Disconnect wiring at starter motor solenoid and remove two screws securing starter motor to engine and remove starter motor.

28. Remove one screw securing brace at final drive.

29. Remove two nuts securing right exhaust pipe clamp at exhaust manifold.

30. Remove four screws securing transmission front cover to transmission.

NOTE: Upper left screw is accessible with an extension and universal socket.

31. Remove three converter to flex plate attaching screws.

NOTE: This is done by removing cork in harmonic balancer and inserting a screw in the harmonic balancer. Rotate the screw to gain access to flex plate to converter screws. Do not pry on flex plate ring gear to rotate converter, as flex plate may become damaged.

32. Remove vacuum modulator line at transmission and at engine and remove line.

33. Working through center cross member, loosen, but do not remove, two transmission mounting nuts.

34. Remove two nuts and washers securing engine mounting studs to front frame cross member.

CAUTION: There is one bolt left securing the final drive housing to the engine support bracket and two screws securing the transmission to the spacer to the engine. Do not proceed further until chain hoist cable is connected to the engine as engine may shift.

35. Attach chain hoist cable to engine and take up slack.

36. Remove lower right and left transmission to adapter to cylinder block screws.

37. Place small jack under final drive housing to support final drive and transmission.

38. Remove bolt and lockwasher securing final drive housing to engine support bracket.

39. Remove engine by pulling it slightly forward to disengage from transmission and up from engine compartment. Turn engine slightly clockwise while removing to clear engine compartment.

40. Secure Converter Holding Strap, J-21366, to transmission case using a 5/16 x 18 nut, as converter is now free.

b. Installation

1. Remove converter holding strap from transmission.

2. Turn engine slightly clockwise and lower into engine compartment until engine has clearance. Then straighten engine and lower, engaging two locating dowels on adapter with holes in transmission. Engine should be positioned so that studs in front are almost but not quite engaged with front frame crossmember.

3. Install four transmission to adapter screws and two screws that secure transmission to adapter to engine. Tighten screws to 30 ft. lbs.

4. Install final drive to engine support bracket with bolt and lockwasher, tightening to 75 ft. lbs., and remove small jack supporting final drive housing and transmission.

5. Drop engine so that two front studs engage front frame crossmember. Install washer and nuts and tighten to 30 ft. lbs.

6. Working through center crossmember, tighten two transmission mounting bolts to 50 ft. lbs.

7. Install vacuum modulator line tubing at engine and transmission. Secure line clamp to rear of right cylinder head with one screw.

8. Rotate screw in harmonic balancer to align weld nuts with screw holes in flex plate, and slide converter forward until weld nuts are flush with flex plate. Make certain that converter is not cocked and that pilot in center of converter is properly seated in end of crankshaft. Tighten screws to 28 foot pounds.

CAUTION: Any deviation from this procedure may result in improper installation and damage to flex plate and transmission. It is important that converter be properly aligned with flex plate so that there is no possibility of draw-up when attaching bolts are installed. If draw-up occurs, converter will become mispositioned, resulting in damage to flex plate and transmission.

9. Position front cover on transmission and secure with four screws.

NOTE: Upper left screw may be installed with an extension and universal socket.

10. Install right output shaft as described in Section 3, Note 38b.

11. Secure right exhaust manifold pipe clamp to exhaust manifold with two nuts.

12. Secure brace at final drive with one screw tightening to 25 ft. lbs.

13. Position starter motor on engine and secure with two screws. Ground strap is secured to outboard screw. Connect wiring at solenoid.

14. Secure starter motor retainer clamps at engine mounting and at bearing support with one screw at each clamp.

15. Lower car.

16. Install two nuts that secure left exhaust manifold clamp to exhaust manifold and secure with two nuts.

17. Connect all vacuum hoses leading to intake manifold and carburetor.

18. Connect oil pressure switch connector at rear of engine.

19. If car is equipped with Cruise Control, connect wiring connector at power unit. Connect accelerator linkage at exterior arm, install washer and secure with cotter pin. Also connect two cables at power unit.

20. Connect coil positive terminal wiring and secure wiring harness under retainer clips of left valve cover.

21. Connect wiring connectors at transmission downshift switch.

22. Connect accelerator linkage at carburetor.

23. Install three steering pump bracket to cylinder block screws, tightening to 23 foot-pounds.

24. Remove plug from fuel inlet line and connect fuel line to fuel pump.

25. On cars equipped with A.I.R, install air pump as described in Note 6-138b.

26. On cars equipped with Automatic Climate Control, connect vapor return line near fuel pump and secure clamp that holds two vacuum lines and steel vapor return line.

27. Install fan assembly on water pump pulley and secure with four screws, tightening to 18 foot-pounds.

28. Install left and right fan shrouds and secure with four screws on each shroud.

29. Connect two heater hoses at engine and secure with clamps.

30. Connect heater hose at water control valve.

31. Attach transmission cooler line clip at left front of final drive by securing clamp with one screw.

32. On cars equipped with Automatic Climate Control, install compressor as described in Section 1, Note 91b.

33. Position belts and adjust generator drive belt as described in Section 6, Note 49, and power steering pump drive belt as described in Section 9, Note 3.

34. Connect wires at generator.

35. Close drain cock and fill radiator with coolant.

36. Install air cleaner.

37. Install hood as described in Section 11, Note 2b.

38. Check all wiring for loose connections.

39. Connect negative battery cable.

40. Run engine and check all connections for leaks.

143. Eldorado 693 Engine Support Mountings

Three engine supports are used to mount the engines on Eldorado 693 Coupes. The front support mounting is located behind and below the engine front cover assembly, and the two rear mountings are on the right and left of the transmission.

The front mounting is seated on the main front cross bar (Fig. 2-5) of the frame and is secured by studs. The rear support mountings are actually transmission support mountings. The engine is bolted with six bolts to the transmission.

These engine and transmission support mountings have rubber cushions to absorb vibration and road shock.

It is important, when attaching the engine mountings to engine, transmission and frame, that the proper torques be used.

Nut - Front mounting support bracket to crankcase bolt - 30 foot pounds

Nut - Engine Front support cushion to frame stud - 30 foot pounds
NOTE: Washer must be used with stud on right side.

Nut - Engine front support cushion to engine mounting bracket bolt - 27 foot pounds

Bolt - Engine rear support bracket to transmission - 50 foot pounds

Bolt - Engine rear support assembly to bracket - 50 foot pounds

Bolt - Engine rear support assembly to frame - 50 foot-pounds

Check at all three engine support mounting locations to be sure that no metal-to-metal grounding can occur.

144. Eldorado 693 Engine Oil Pan Removal and Installation

a. Removal

1. Drain engine oil.

2. Remove engine as described in Note 6-142a.

3. Remove two bracket to block bolts on each side of engine front mounting support.

4. Remove nuts and cap screws that hold oil pan to cylinder block and engine front cover, and remove oil pan.

5. Remove side gaskets and rubber front and rear seals from oil pan, and discard them.

b. Installation

1. Cement new gasket to both sides of oil pan, lining up holes in gaskets with holes in oil pan flange.

2. Thoroughly clean front and rear seal surfaces of oil pan, and install new oil pan front and rear seals by pulling locating tangs on seals through locating holes in seal flange. Make sure seals are firmly positioned on flange surfaces with ends of each seal properly located in cut-out notches in side gaskets.

3. Seal all four corner notch openings with a coating of rubber cement.

4. Clean out notches in block where ends of oil pan rear seal fit. Fill this rectangular cavity with Transmission Cooler Hose Cement.

NOTE: This cement will be easier to apply if the tube has been stored in a cool location to prevent the contents from becoming too thin.

5. Position oil pan on bottom surface of cylinder block, and install cap screws, tightening to 10 foot-pounds.

6. Install 12 cap screws that secure oil pan to cylinder block and tighten to 10 foot-pounds.

7. Install engine as described in Note 6-142b.

8. Refill crankcase with engine oil. Check dipstick for proper oil level.

SPECIFICATIONS

Items	All Series Unless Otherwise Noted
Bore	4.130"
Stroke	4.000"
Compression Pressure -	
At cranking speed (throttle open)	165 to 185 psi
At 1000 rpm	212 to 230 psi
Compression Ratio	10.5 to 1
Horsepower --	
Rated (Taxable)	54.6
Developed at 4600 rpm	340
Piston Displacement	429 Cu. In.
Points of Suspension	3
Torque, at 3000 rpm	480 Ft. Lbs.
VALVES, EXHAUST	
Clearance between stem and guide--	
New limits	.0010" - .0025"
Worn limits, not over	.005"
Clearance between lifter body and crankcase	.0005" - .0020"
Head diameter, overall	1.50"
Lift	.440"
Valve Face Angle	44°
Valve Seat Angle (in head)	45°
Seat width in head	1/16"
Seat eccentricity, not over (total indicator reading)	.004"
Stem diameter	.3415" - .3420"
VALVES, INLET	
Clearance between stem and guide--	
New limits (in head)	.0005" - .0025"
Worn limits, not over	.005"
Clearance between lifter body and crankcase	.0005" - .0020"
Head diameter, overall	1.875"
Lift	.440"
Valve Face Angle	44°
Valve Seat Angle (in head)	45°
Seat Width in head	1/16"
Seat eccentricity, not over (total indicator reading)	.004"
Stem diameter	.3415" - .3425"
VALVE SPRINGS	
Free length	2.250"
Pounds required to compress to 1.946" (Valve closed)	60-65
Pounds required to compress to 1.496" (Valve open)	155-165

Items	All Series Unless Otherwise Noted
VALVE TIMING (with ramp at .001" lift)	
Intake opens	39° B.T.D.C.
Intake closes	109° A.B.D.C.
Exhaust opens	86° B.B.D.C.
Exhaust closes	62° A.T.D.C.
CONNECTING RODS	
Bearing Material	M-400 Alum.
Clearance between bearing and shaft--	
New limits	.0005" - .0021"
Worn limits, not over	.0035"
Diameter lower end, without bearing	2.3740" - 2.3745"
Length, center to center	6-1/2"
End play of rods on crank pin	.008" - .014"
PISTON RINGS	
Clearance between rings and sides of groove in piston--	
Compression rings	.0022" - .0035"
Oil rings	NONE - Side Sealing
Gap between ends	
Compression rings	.013" - .020"
Oil rings	.015" - .055"
Number of compression rings	2
Number of oil rings	1
Width of compression ring groover	.0647" - .0655"
Width of oil ring groove	.188" - .189"
Diameter at bottom of groove	
Oil ring	3.760" - 3.765"
Compression rings	3.663" - 3.668"
PISTON PINS	
Clearance between pin and piston--	
New limits	.00005" to .00015" at 70°F
Pin length	3.090"
Pin diameter	.9994" - .9997"
PISTONS AND CYLINDERS	
Cylinder bore out of round (new or reground limit)	
Not over	.0005"
Taper, not over	.0007"
Cylinder bore, standard	4.1290" - 4.1310"

SPECIFICATIONS (CONT'D.)

Items	All Series Unless Other-wise Noted
Cylinder and piston sizes (as indicated by letters stamped on the valve lifter compartment cover rail next to the inside edge of the cylinder head. The letters are in groups of two for adjacent cylinders (such as "H" and "B") midway between the two cylinders. The letters denote the cylinder piston sizes as shown below.)	

Letter	Cylinder Size (Diameter in Inches)	Piston Size (Diameter in Inches)
A	4.1290 - 4.1292	4.1282 - 4.1284
B	4.1292 - 4.1294	4.1284 - 4.1286
C	4.1294 - 4.1296	4.1286 - 4.1288
D	4.1296 - 4.1298	4.1288 - 4.1290
E	4.1298 - 4.1300	4.1290 - 4.1292
H	4.1300 - 4.1302	4.1292 - 4.1294
J	4.1302 - 4.1304	4.1294 - 4.1296
K	4.1304 - 4.1306	4.1296 - 4.1298
L	4.1306 - 4.1308	4.1298 - 4.1300
M	4.1308 - 4.1310	4.1300 - 4.1302
AA	4.1390 - 4.1392	4.1382 - 4.1384
BB	4.1392 - 4.1394	4.1384 - 4.1386
CC	4.1394 - 4.1396	4.1386 - 4.1388
DD	4.1396 - 4.1398	4.1388 - 4.1390
EE	4.1398 - 4.1400	4.1390 - 4.1392
HH	4.1400 - 4.1402	4.1392 - 4.1394
JJ	4.1402 - 4.1404	4.1394 - 4.1396
KK	4.1404 - 4.1406	4.1396 - 4.1398
LL	4.1406 - 4.1408	4.1398 - 4.1400
MM	4.1408 - 4.1410	4.1400 - 4.1402

Items	All Series Unless Other-wise Noted
Piston Material	FT-132-T5 Aluminum Alloy
Piston skirt top clearance	.0006" - .0010"
Piston skirt bottom clearance	.000"
OIL PUMP	
Backlash between drive gears	.008" - .012"
Clearance between pump body drive shaft--	
New limits	.0010" - .0025"
Worn limits, not over	.005"
Clearance between pump body and gears--	
New limits	.003" - .005"
Worn limits, not over	.005"
End play in pump gears--	
New limits	.001" - .004"
Worn limits, not over	.006"
Oil pump type	Spur Gear
No. of teeth on each gear	9
CRANKSHAFT AND MAIN BEARINGS	
Clearance, main bearings--	
New limits	.0008" - .0029"
Worn limits, not over	.0045"
Main bearing caps--	
Bolt thread diameter	1/2"
Main bearing journal, diameter	3"
Main bearing journals, out-of-round not over	.00025"
Main bearing journal length--	
Front	1.068"
Intermediate	.935"
Rear	1.622"
Main bearings, material	M400 Aluminum and M100 Babbitt
Crankpin diameter	2.2488" - 2.2493"
Crankpin out-of-round not over	.00025"
End play in crankshaft--	
New limits	.001" - .007"
Worn limits	.010"
OIL PRESSURE REGULATOR	
Clearance between valve plunger and housing--	
New limits	.0020" - .0035"
Worn limits, not over	.005"
Normal pressure to 30 mph	
Minimum	30-35 psi
Idle (average)	10 psi
Spring	
Free length (approx.)	2.77" to 2.89"
Lbs. required to compress to 1-7/16"	6-1/4 to 6-3/4
Valve opens at	30-35 psi
CAMSHAFT	
Chain--	
Adjustment	None
Length	23"
Type	Silent Chain
Number of links	46
Pitch	.500"
Width	7/8"
Bearing Clearance--	
New limits	.001" - .0022"
Worn limits, not over	.004"
Bearing out-of-round, not over	.002"
Number of bearings	5
Cam lift (intake)	.266"
Cam lift (exhaust)	.266"

PULLEY DRIVE RATIOS

Pulley	Air Conditioned	Non Air Conditioned
Fan	1.1 :1	1.1 :1
Generator	2.78 :1	2.78:1
Power Steering Pump	1.24 :1	1.24:1
Refrigerant Compressor	1.392:1	
A.I.R. Air Pump	1.5 :1	1.5 :1

TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
260M	A/C Compressor Adjusting Bracket Bolt	5/16-24	18 ft. lbs.
260M	Air Pump Housing Cover Screw	5/16-18	12 ft. lbs.
280M	Air Pump Rotor Ring Screw	10-24	37 in. lbs.
280M	Air Pump Pulley Screw	5/16-24	18 ft. lbs.
280M	Camshaft Sprocket to Camshaft Screw	5/16-18	18 ft. lbs.
280M	Carburetor to Intake Manifold Screw (Front). . .	5/16-18	8 ft. lbs.
280M	Carburetor to Intake Manifold Bolt (Rear)	5/16-18	14 ft. lbs.
Special	Connecting Rod Nut	3/8 -24	40 ft. lbs.
300M	Cylinder Head to Cylinder Block Screw (All - Special) Oiled	13/32-16	60 ft. lbs.
286M	Distributor Clamp Nut	5/16-24	18 ft. lbs.
286M	Engine Front Support Mount to Cylinder Block Nut	3/8-24	30 ft. lbs.
280M	Engine Rear Support Mount to Rear Support Cross Member Bolt	7/16-14	50 ft. lbs.
280M	Engine Rear Support Cross Member to Frame Bolt	5/16-18	20 ft. lbs.
280M	Engine Rear Support Mount to Transmission Extension Housing Bolt	7/16-14	50 ft. lbs.
286M	693 Engine Front Mounting Support Bracket to Crankcase Nut	3/8-24	30 ft. lbs.
286M	693 Engine Front Support Cushion to Frame Nut	7/16-24	30 ft. lbs.
286M	693 Engine Front Support Cushion to Engine Mounting Bracket Nut	3/8-16	27 ft. lbs.
280M	693 Engine Rear Support Bracket to Transmission Bolt	7/16-14	50 ft. lbs.
280M	693 Engine Rear Support Assembly to Bracket .	7/16-14	50 ft. lbs.
280M	693 Engine Rear Support Assembly to Frame . .	1/2-13	50 ft. lbs.
280M	Exhaust Manifold to Cylinder Head Screw	7/16-14	60 ft. lbs.
280M	Fan Blade Assembly Mounting Screw on Air Conditioned Cars	5/16-24	18 ft. lbs.
260M	Fan Blade Assembly Mounting Screw on Non-Air Conditioned Cars	5/16-24	18 ft. lbs.
280M	Fan Blade to Clutch Mounting Bolt on Air Conditioned Cars	5/16-24	20 ft. lbs.
1010	Fan Shroud to Radiator Support Bracket Screw .	1/4-20	120 in. lbs.
280M	Flex Plate to Converter Screw	3/8-16	25 ft. lbs.
280M	Flex Plate to Crankshaft Screw (All)	7/16-20	75 ft. lbs.
260M	*Front Cover to Cylinder Block Screw	5/16-18	10 ft. lbs.
Special	Front Plate and Lower Cover Adapter Bolt . . .	1/4-20	60 in. lbs.
286M	Front Support Mount Stud to Frame Nut	1/2-20	60 ft. lbs.
260M	Fuel Pump to Front Cover Screw	3/8-16	15 ft. lbs.
260M	Generator Adjusting Link to Generator Screw . .	5/16-18	10 ft. lbs.
260M	Generator Support Bracket to Exhaust Manifold Screw	3/8-16	18 ft. lbs.
1112	Generator Support Bracket to Exhaust Manifold Nut	3/8-24	18 ft. lbs.
1010	Heater Hose Clamps	10-24	14 in. lbs.
260M	Ignition Coil Mounting Screw	5/16-18	18 ft. lbs.
286M	Intake Manifold to Cylinder Head Nut	3/8-24	25 ft. lbs.

TORQUE SPECIFICATIONS (CONT'D.)

Material No.	Application	Thread Size	Torque
280M	Intake Manifold to Cylinder Head Screw	3/8-16	30 ft. lbs.
Special	Lower Cover to Transmission Case Screw . . .	1/4-20	80 in. lbs.
260M	Lower and Upper Flywheel Housing Plate Screws .	5/16-18	15 ft. lbs.
300M	Main Bearing Cap to Cylinder Block Screw . . .	1/2-13	95 ft. lbs.
260M	Oil Pan Drain Plug	5/8-18	28 ft. lbs.
Special	Oil Pan to Cylinder Block Nut	5/16-24	10 ft. lbs.
Special	Oil Pan to Cylinder Block Screw	5/16-18	10 ft. lbs.
280M	Oil Intake Screen Assembly to Cylinder Block Screw	5/16-18	18 ft. lbs.
Steel	Oil Pressure Plug	3/8 Pipe	11 ft. lbs.
Special	Oil Pressure Switch	1/4 Pipe	20 ft. lbs.
260M	Oil Pump Cover Assembly to Front Cover Screw .	5/16-18	10 ft. lbs.
260M	Oil Filter to Oil Pump Cover Assembly Nipple . .	5/8-16	15 ft. lbs.
280M	Pulley to Harmonic Balancer Screw	5/16-18	15 ft. lbs.
1010	Radiator Hose Clamp.	12-14	26 in. lbs.
1010	**Rocker Arm Cover to Cylinder Head Screw . . .	1/4-20	28 in. lbs.
S.A.E.	Speedo Drive Sleeve	5/16-16	25 ft. lbs.
260M	Speedo Driven Gear Sleeve to Transmission Extension Housing	5/16-18	18 ft. lbs.
300M	Starter Motor Brace Screw	5/16-18	25 ft. lbs.
280M	Starter Motor Mounting Screw.	3/8-16	25 ft. lbs.
Special	Spark Plug	14 MM	25 ft. lbs.
286M	Steering Pump Pulley Nut	9/16-18	58 ft. lbs.
Special	Temperature Indicator Thermal Unit	1/2 Pipe	40 ft. lbs.
260M	Thermostat Housing to Water Outlet Pipe Screw	5/16-18	10 ft. lbs.
1010-1020 STL	Transmission Front Plate and Lower Cover to Cylinder Block	1/4-20	60 in. lbs.
280M	Transmission Housing to Cylinder Block	3/8-16	30 ft. lbs.
1010	Transmission Oil Cooler Line Clip to Cylinder Block	5/16-24	10 ft. lbs.
260M	Valve Lifter Compartment Cover to Cylinder Block Screw	1/4-20	25 in. lbs.
260M	Ventilator Valve Connector to Cylinder Block Screw	1/4-20	25 in. lbs.
260M	Water Outlet Pipe to Cylinder Head Screw . . .	3/8-16	20 ft. lbs.
260M	Water Pump to Front Cover Screw	1/4-20	5 ft. lbs.
260M	*Water Pump to Cylinder Block Screw	3/8-16	20 ft. lbs.
260M	*Water Pump to Cylinder Block Screw	5/16-18	10 ft. lbs.

*Refer to Fig. 6-113, for proper location.
**Retorque rocker arm covers after engine has been run.

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.

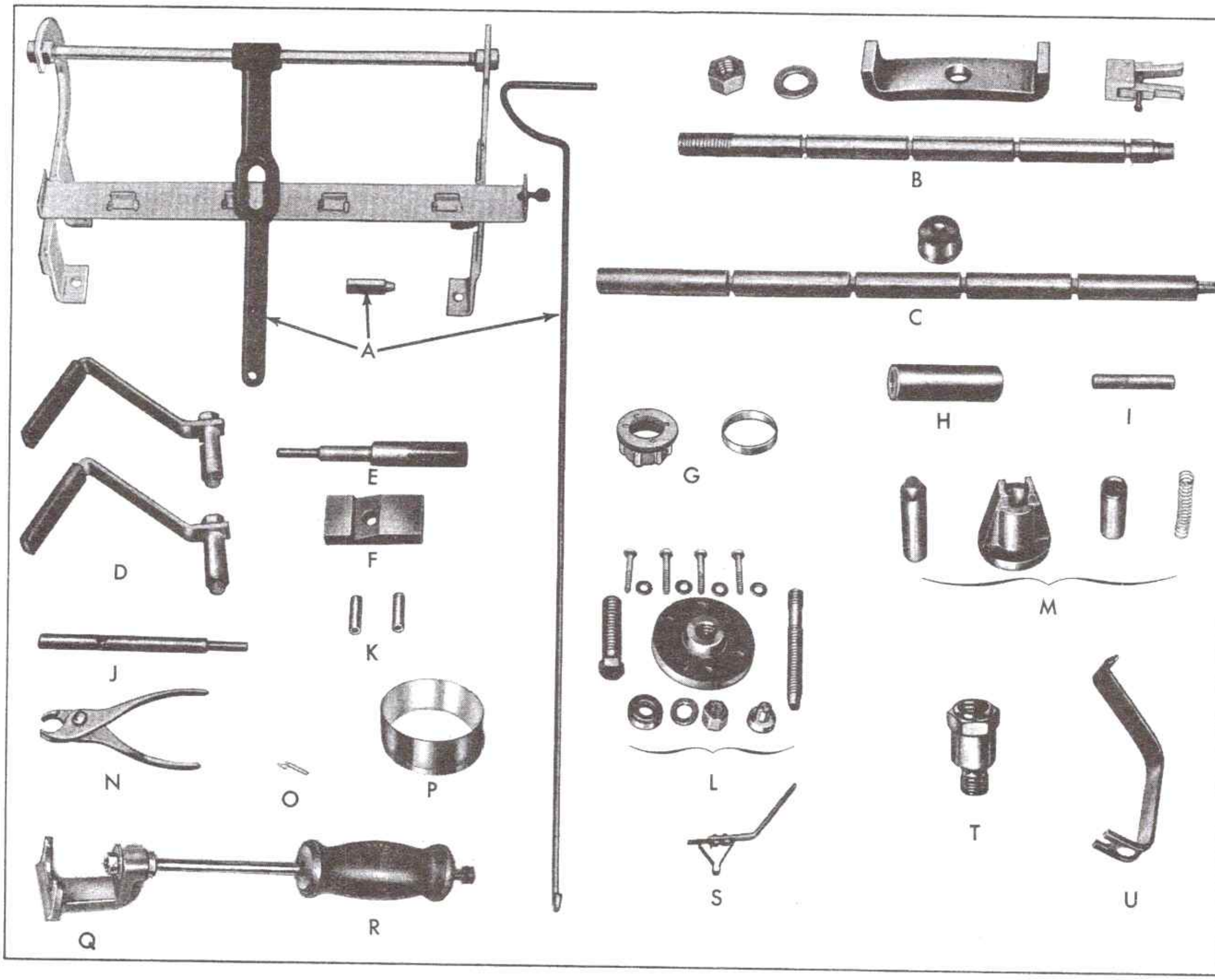


Fig. 6-166 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-3064	Cylinder Head Holder and Valve Spring Compressor	L	J-21052	Harmonic Balancer Remover and Installer Set
B	J-3063	Camshaft Bearing Remover Set	M	J-8390	Piston Pin Remover and Installer Set
C	J-21054	Camshaft Bearing Remover and Installer Set			
D	J-4159	Cylinder Head Lifting Hooks	N	J-3049	Valve Lifter Remover
E	J-22315	Valve Stem Guide Driver	O	J-8080	Main Bearing Upper Shell Remover
F	J-6535	Gaging Block			
G	J-21150	Front Cover Oil Seal Installer Set	P	J-22095	Piston Ring Compressor
H	J-4160	Hydraulic Valve Lifter Plunger Remover	Q	J-21930	Tie Rod End Puller
			R	J-6125	Slide Hammer
I	J-2730	Valve Lifter Lock Ring Installer	S	J-3074	Valve Lifter Leak-Down Tester
J	J-3062	Valve Stem Guide Remover	T	J-9388	Adapter
K	J-3224	Connecting Rod Bolt Guide Set	U	J-5892-1	Valve Spring Compressor

GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado, refer to the latter portion of this section.

The same basic Turbo Hydra-matic automatic transmission, Fig. 7-1, is used on all 1967 Cadillac cars. There are some differences between transmissions, however, dependent upon the series car. The various transmissions used are identified by the large letters AA, AB, or AC that appear in the upper corners of the name plate, Fig. 1-1, located on the right hand side of the transmission.

Transmissions bearing the designation AA are used on 680, 681, 682, and 683 series cars. Those bearing the designation AB are used on 698 series cars, and the AC transmissions are used on 697 series cars. AA transmissions have a variable pitch stator not found in AB or AC transmissions. The extension housing bushings on AB transmissions that support the output shaft are positioned closer together than those used on the AA or AC transmissions. Different speedometer gearing arrangements are used for each transmission.

The Turbo Hydra-matic transmission is a fully automatic unit consisting primarily of a 3-element hydraulic torque converter and a compound planetary gear set. Three multiple-disc clutches, a sprag unit, a roller clutch unit, and two bands provide the friction elements required to obtain the desired functions of the compound planetary gear set.

The torque converter, the clutches, the sprag and roller clutch, couple the engine to the planetary gears through oil pressure, providing three forward speeds and reverse. The torque converter, when required, will supplement the gears by multiplying engine torque.

The torque converter is of welded construction and is serviced as an assembly. The unit is made up of two vaned sections, or halves, that face each other in an oil filled housing. The pump half of the converter is connected to the engine and the turbine half is connected to the transmission.

When the engine makes the converter pump revolve, it sends oil against the turbine, making it revolve also. The oil then returns in a circular flow back to the converter pump, continuing this flow as long as the engine is running.

The converter also has a smaller vaned section, called a stator, that funnels the oil back to the converter pump through smaller openings, at increased speed. The speeded up oil directs additional force to the engine-driven converter pump, thereby multiplying engine torque.

The stator assembly on all AA transmissions is a variable pitch stator. The stator blades are operated at either of two positions; maximum or high angle, and minimum or low angle.

Maximum or high stator angle means greater redirection of the oil and increased engine speed and torque multiplication for maximum performance. At engine idle it reduces the converter's efficiency, reducing "creep." Minimum or low angle results in a more efficient converter for cruising operation.

A hydraulic system pressurized by an internal-external type gear pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections to the transmission are:

Manual Linkage - To select the desired operating range.

Engine Vacuum - To operate a vacuum modulator unit.

12 Volt Electrical Signals - To operate an electrical detent solenoid used on all transmissions, and the stator solenoid used on AA transmissions only.

Gear or Torque ratios of the transmission are as follows:

First = 2.48:1 gear ratio

Second = 1.48:1 gear ratio

Third = 1.0:1 gear ratio

Reverse = 2.08:1 gear ratio

Each gear ratio can be multiplied by as much as 2, depending upon the slip speed of the converter pump and turbine.

A vacuum modulator is used to sense engine torque input to the transmission automatically. The vacuum modulator transmits this signal to the pressure regulator, which controls line pressure, so that all torque requirements of the transmission are met and proper shift spacing is obtained at all throttle openings.

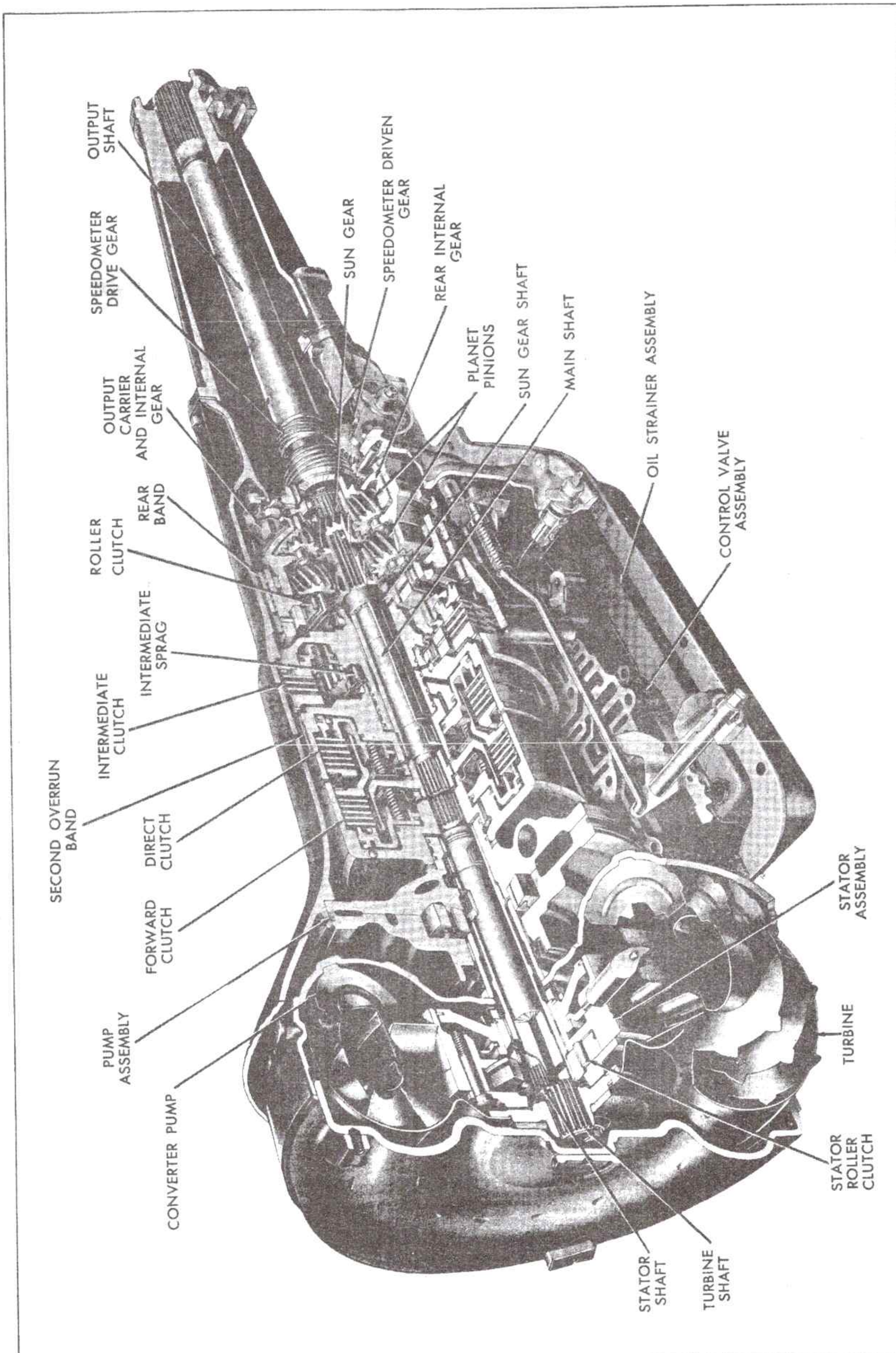


Fig. 7-1 Turbo Hydra-Matic Transmission Cutaway

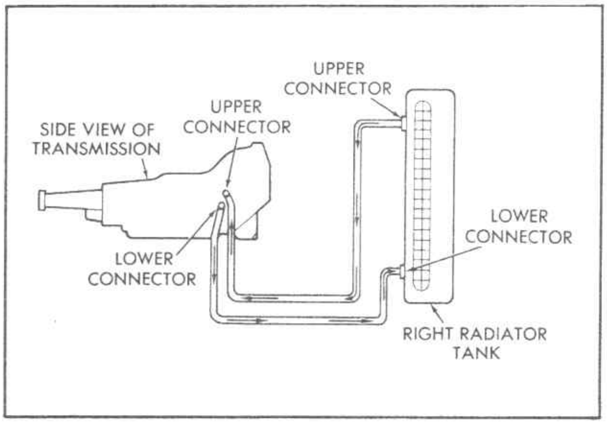


Fig. 7-2 Oil Cooler Lines

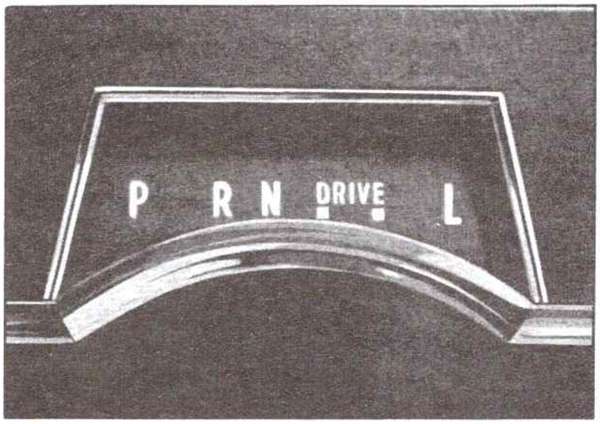


Fig. 7-3 Selector Quadrant

The detent solenoid is activated by a switch at the carburetor. When the throttle is opened sufficiently to close this switch, the solenoid in the transmission is activated, causing a downshift at speeds below 70 miles per hour. At lower speeds, downshifts will occur at lesser throttle openings without use of the switch.

On all cars equipped with the AA transmission, the stator solenoid is activated by a signal from the switch at the carburetor. The switch at the carburetor changes the stator blades from low to high angle above 40° throttle opening, and below 6° throttle opening.

The oil cooler is located in the right hand tank of the radiator, Fig. 7-2. The transmission is cooled by directing oil from the converter to the radiator. Oil returning from the radiator feeds the transmission lubrication system.

The oil system incorporates an intake pipe and strainer assembly. An internal by-pass in the strainer permits increased oil flow during cold operation when the oil is heavier. The intake pipe and strainer assembly should be replaced after the first 24,000 miles or two years, whichever occurs first, or in any case where a major transmission failure has occurred. In the event of a major transmission failure, the converter assembly should also be replaced, and the oil cooler and lines should be flushed.

The transmission quadrant has six selector positions, Fig. 7-3, that enable the driver to control the operation of the transmission under various driving conditions. The six selector positions appear on the quadrant in the following sequence, from left to right; P-park, R-reverse, N-neutral, DRIVE left, DRIVE right (intermediate) and L-lo.

The engine can be started in the Park and Neutral positions only.

P - Park position positively locks the output shaft to the transmission case by means of a locking pawl and prevents the vehicle from rolling either forward or backward. The engine may be started in Park position.

R - Reverse enables the vehicle to be operated in a reverse direction.

N - Neutral position enables the engine to be started and run without driving the vehicle.

Drive (left) - Drive (left) is used for all normal driving conditions and maximum economy.

Drive (left) has three gear ratios from starting to direct drive. Downshifts are available for safe passing, by depressing the accelerator pedal.

Drive (right) - Drive (right) adds performance for congested traffic or hilly terrain. This range has the same starting ratio as Drive (left), but prevents the transmission from shifting above second speed to retain acceleration when extra performance is desired. Engine braking is provided in this range.

L - Lo range permits operation at a lower gear ratio, and should be used where maximum torque multiplication is desired, such as in pulling a heavy load or descending a steep grade. When selector lever is moved from Drive to Lo range at normal highway speeds, the transmission will shift to second gear and remain in second gear until vehicle speed is reduced to the normal 2-1 downshift speed. The transmission will then shift to first gear and remain in first gear regardless of vehicle or engine speed, until selector lever is moved back into either of the Drive positions.

HYDRAULIC SYSTEM DESCRIPTION

Pressure Control

The transmission is controlled automatically by a hydraulic system, Fig. 7-4. Hydraulic pressure is supplied by the transmission oil pump, which is engine driven. Main line pressure is controlled by a pressure regulator valve train located in the pump and by the vacuum modulator which is connected to engine vacuum. The pressure regulator controls line pressure automatically, in response to a pressure signal from a modulator valve. In such a way that the torque requirements of the transmission clutches are met and proper shift spacing is obtained at all throttle openings.

To control line pressure properly, a modulator pressure is used which varies in the same manner as torque input to the transmission. Since the torque input to the clutches is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum, which is an indicator of engine torque and carburetor opening. It will decrease with an increase in vehicle speed to compensate for the changing converter torque ratio, by virtue of the governor pressure influence.

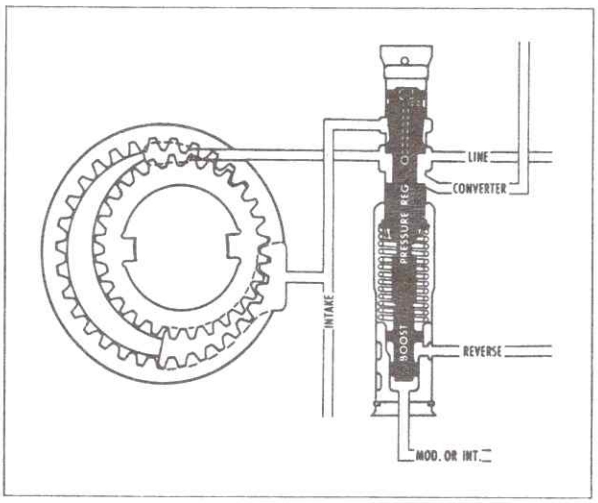


Fig. 7-4 Pressure Control

Vacuum Modulator Assembly

The engine vacuum signal is received by the vacuum modulator, Fig. 7-5, which consists of an evacuated metal bellows, a diaphragm and a spring. These are so arranged that the bellows and spring apply a force that acts on the modulator valve so that it increases modulator pressure. Engine vacuum and a spring oppose the bellows and spring to control modulator pressure.

To reduce the effect of altitude on shift points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

Governor Assembly

The vehicle speed signal to the transmission is supplied by the governor, Fig. 7-6, which is driven by the output shaft. The governor consists of flyweights and a regulator valve. Centrifugal force of the flyweights is imposed on the regulator valve, causing it to regulate a pressure signal that increases with speed.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as vehicle speed increases.

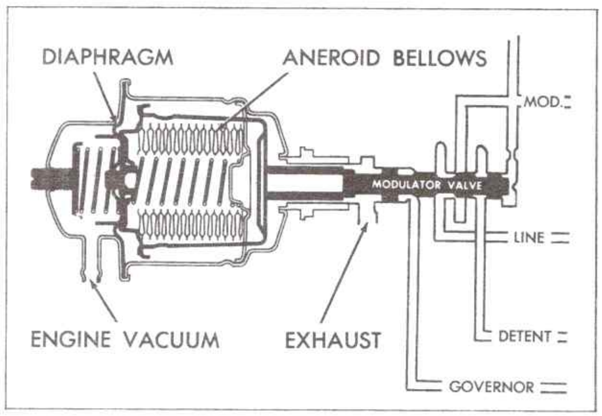


Fig. 7-5 Vacuum Modulator Assembly

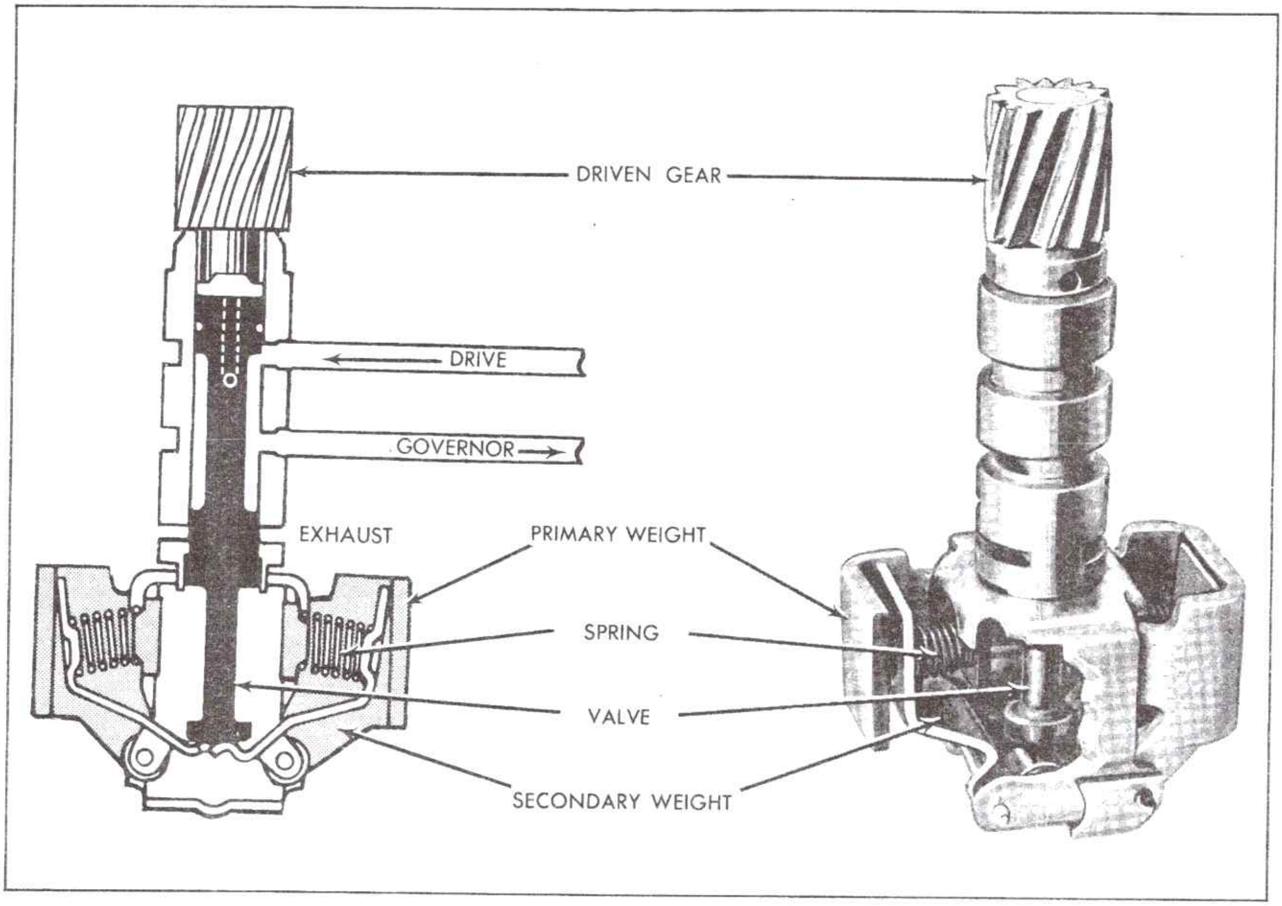


Fig. 7-6 Governor Assembly

FUNCTIONS OF VALVES AND HYDRAULIC CONTROL UNITS

Line Pressure Regulator

Regulates line pressure according to pump speed and engine torque.

Manual Valve

Establishes the range of transmission operation, P, R, N, DRIVE (left, right), L, as selected by the vehicle operator through the manual selector lever.

Governor Assembly

Generates a speed sensitive oil pressure that increases with output shaft or vehicle speed. Governor pressure is used to control the shift points and modulator pressure regulation.

Vacuum Modulator Valve

Provides modulator pressure that senses engine torque and vehicle speed. The vacuum modulator is used to vary the shift points according to throttle opening and to raise line pressure proportional to engine torque.

1-2 Shift Valve

Controls the speeds at which the 1-2 and 2-1 shifts occur.

1-2 Regulator Valve

Regulates modulator pressure to a proportional pressure, tending to keep 1-2 shift valve in downshift position.

1-2 Detent Valve

Senses regulated modulator pressure tending to hold 1-2 shift valve downshifted and provides an area for detent pressure for detent 2-1 shifts.

2-3 Shift Valve

Controls the speeds at which the 2-3 and 3-2 shifts occur.

2-3 Modulator Valve

Senses modulator pressure to apply a variable force that tends to hold the 2-3 shift valve downshifted.

3-2 Valve

Shuts off modulator pressure from acting on the shift valves after the direct clutch has been applied. This allows fairly heavy throttle operation in third speed without downshifting. In third speed, detent pressure or modulator pressure above 87 psi can be directed to the shift valves to provide the downshift forces.

1-2 Accumulator Valve

Regulates drive oil to a proportional lesser value that increases as modulator pressure increases, to control engagement of the intermediate clutch.

Detent Valve

Shifts when line oil is exhausted at the end of the valve when the detent solenoid is energized. This directs detent oil to the 1-2 and 2-3 modulator valves and allows the detent regulator valve to regulate.

Detent Regulator Valve

When the detent valve shifts, the detent regulator is freed to allow drive oil to enter the detent passage and thus becomes regulated at 70 psi. Detent pressures will also flow into the modulator passage which flows to the shift valves. Lo oil moves the detent regulator open to drive oil, allowing drive oil to enter the modulator and detent passages.

Stator Valve (All AA Transmissions)

One of the factors affecting the degree of converter torque multiplication is the angle of the stator blades. The stator blades shift when line oil is exhausted at end of the valve when the stator control solenoid is energized. This exhausts oil from the variable pitch stator piston and changes the blades from low to high angle. When the stator solenoid is not energized, converter oil is directed to the stator piston and low angle is obtained.

Rear Servo and Accumulator Assembly

The rear servo applies the rear band for engine braking in Lo Range 1st gear. It applies the band in Reverse to hold the reaction carrier to provide the reverse gear ratio.

On the 1-2 shift in Drive (left and right), it serves as an accumulator for the intermediate clutch to provide a smooth shift.

Front Servo

The front servo applies the 2nd overrun band to provide engine braking in 2nd gear in Drive (right) and Lo Ranges. It is also used as an accumulator for the apply of the direct clutch, and in conjunction with a series of check balls controlling orifices, is a part of the timing for the release of the direct clutch.

To prevent the apply of the 2nd overrun band in Neutral, Drive (left) and Reverse ranges, oil is directed from the manual valve to the release side of the servo piston.

In Drive (left) the servo release oil from the manual valve is used to charge the servo in preparation for the apply of the direct clutch.

Direct clutch oil is directed to the front servo accumulator piston where spring force plus direct clutch pressure stroke the piston up against the force of servo release oil. This lowers the clutch apply pressure for a smooth engagement.

The release of the direct clutch and the exhausting of the front servo accumulator is slowed down by three check balls and three orifices which permits a soft return of the drive load to the intermediate sprag and also allows engine rpm to increase during a detent 3-2 downshift in preparation for the lower gear ratio, which results in a smooth shift and better acceleration.

PARK OR NEUTRAL—ENGINE RUNNING POWER FLOW

Forward Clutch - Released

Roller Clutch - Ineffective

Direct Clutch - Released

Front Band - Released

Rear Band - Released

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

In Neutral or Park no bands or clutches are applied, therefore no power is transmitted.

OIL FLOW (Fig. 7-7)

Whenever the engine is running at idle with the selector lever in "P" or "N", oil from the pump is directed to the:

1. Pressure Regulator Valve
2. Converter
   a. Oil Cooler
   b. Cooler By-Pass Valve
   c. Lubrication System
   d. Stator Valve
3. Manual Valve
4. Detent Valve
5. Detent Solenoid
6. Vacuum Modulator Valve
7. Front Servo (Neutral only)
8. Stator Solenoid and Valve

Cooling and Lubrication

Oil flows from the pump to the pressure regulator valve which regulates pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the converter feed passage to fill the converter, and is directed to the stator valve. Oil from the converter is directed to the transmission cooler by-pass valve. Oil from the cooler is directed to the transmission lubrication system.

The cooler by-pass valve permits oil to be fed directly from the converter to lubrication circuits if the cooler becomes restricted.

Line pressure acts on the:

1. Manual Valve
2. Detent Valve
3. Detent Solenoid
4. Modulator Valve
5. Stator Valve
6. Stator Solenoid

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1-2 accumulator valve, and passes through the detent valve and 3-2 valve to the 1-2 and 2-3 valve trains.

Stator Blade Angle (All AA Transmissions)

Line oil at the stator valve and stator solenoid is exhausted through an orifice at the solenoid. This allows the stator valve spring to move the stator valve, cutting off converter oil and allowing stator oil to exhaust. This places the stator blades at high angle.

Summary

The converter is filled, stator blades are at high angle, and all clutches and bands are released. The transmission is in Neutral.

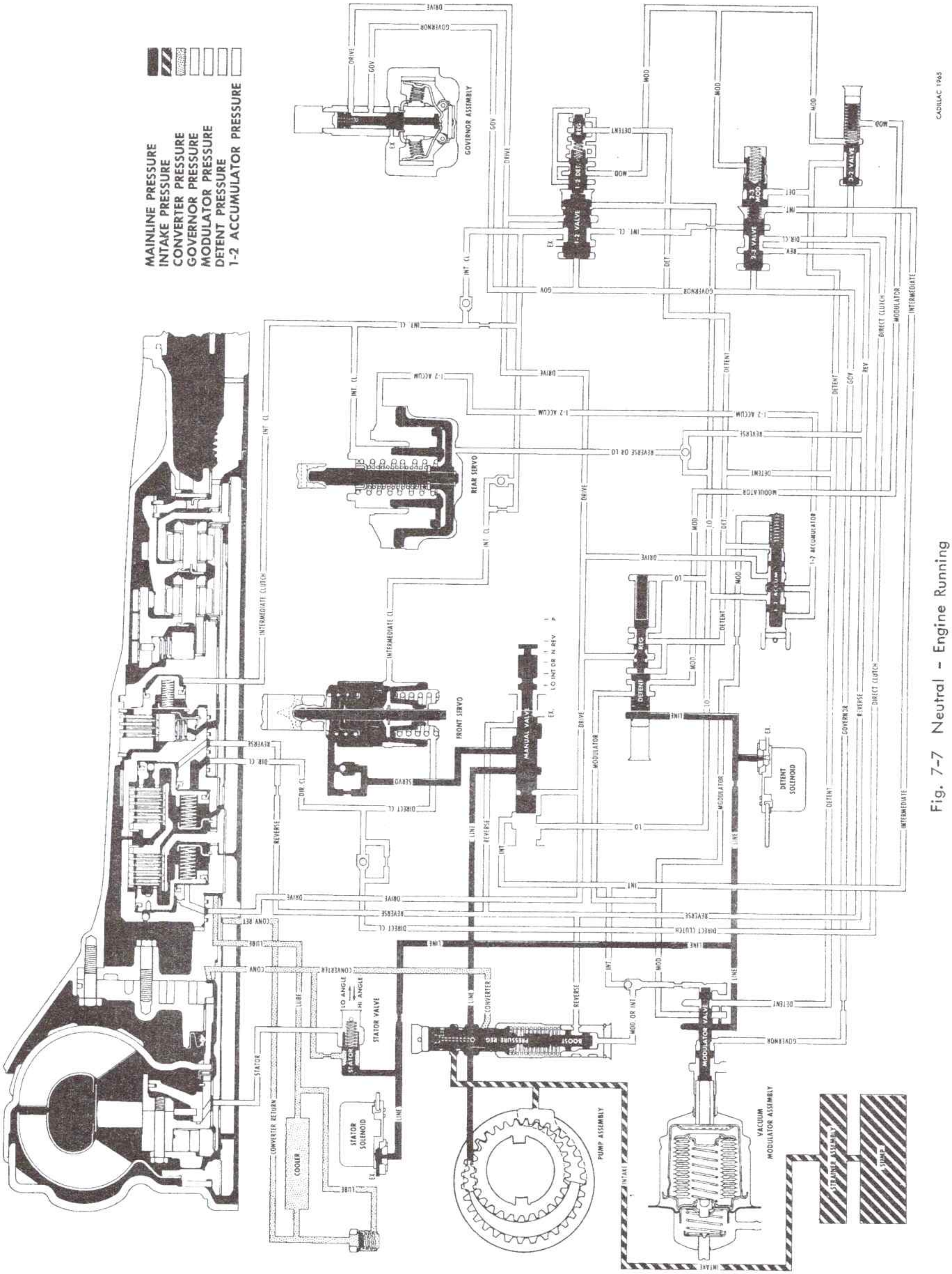


Fig. 7-7 Neutral - Engine Running

DRIVE LEFT AND RIGHT—FIRST SPEED POWER FLOW

Forward Clutch - Applied

Roller Clutch - Effective

Direct Clutch - Released

Front Band - Released

Rear Band - Released

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

With the selector lever in either Drive Range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear in a clockwise direction. (Converter torque ratio = approximately 2:1 at stall.)

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear counterclockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.48:1. Reaction of the front pinions against the front internal gear is taken by reaction carrier and roller clutch assembly to the transmission case. (Approximate stall ratio - 5:1).

OIL FLOW (Fig. 7-8)

When the selector lever is moved to either Drive position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the:

1. Forward Clutch
2. 1-2 Shift Valve
3. Governor Assembly
4. 1-2 Accumulator Valve
5. Detent Regulator Valve

Basic Control

Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to insure a smooth shift into Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure increases with vehicle speed and acts against the ends of the 1-2 and 2-3 shift valves and an area on the modulator valve.

Drive oil is also regulated to another variable pressure at the 1-2 accumulator valve. This pressure is controlled by modulator oil and is directed to the rear servo. 1-2 accumulator oil at the rear servo acts on the accumulator piston. In addition, to maintain the lower pressure in the 1-2 accumulator passage, the 1-2 accumulator valve intermittently uncovers the lo oil passage and oil is exhausted at the manual valve.

Stator Blade Angle

(AA Transmissions Only)

When at idle, the stator blades are at high angle reducing the converter's efficiency, thus reducing "creep." Under heavy throttle operation, the stator blades are at high angle, due to the stator carburetor switch being activated, thus resulting in increased torque multiplication for maximum performance.

At light or medium throttle, (as shown), the solenoid is not activated. Line pressure moves the stator valve against its spring, allowing converter oil to act on stator piston putting the blades at low angle, resulting in a more efficient converter for cruising operation.

Summary

The converter is filled and the stator blades are at either high or low angle, depending upon throttle position. The forward clutch is applied. The transmission is in first gear.

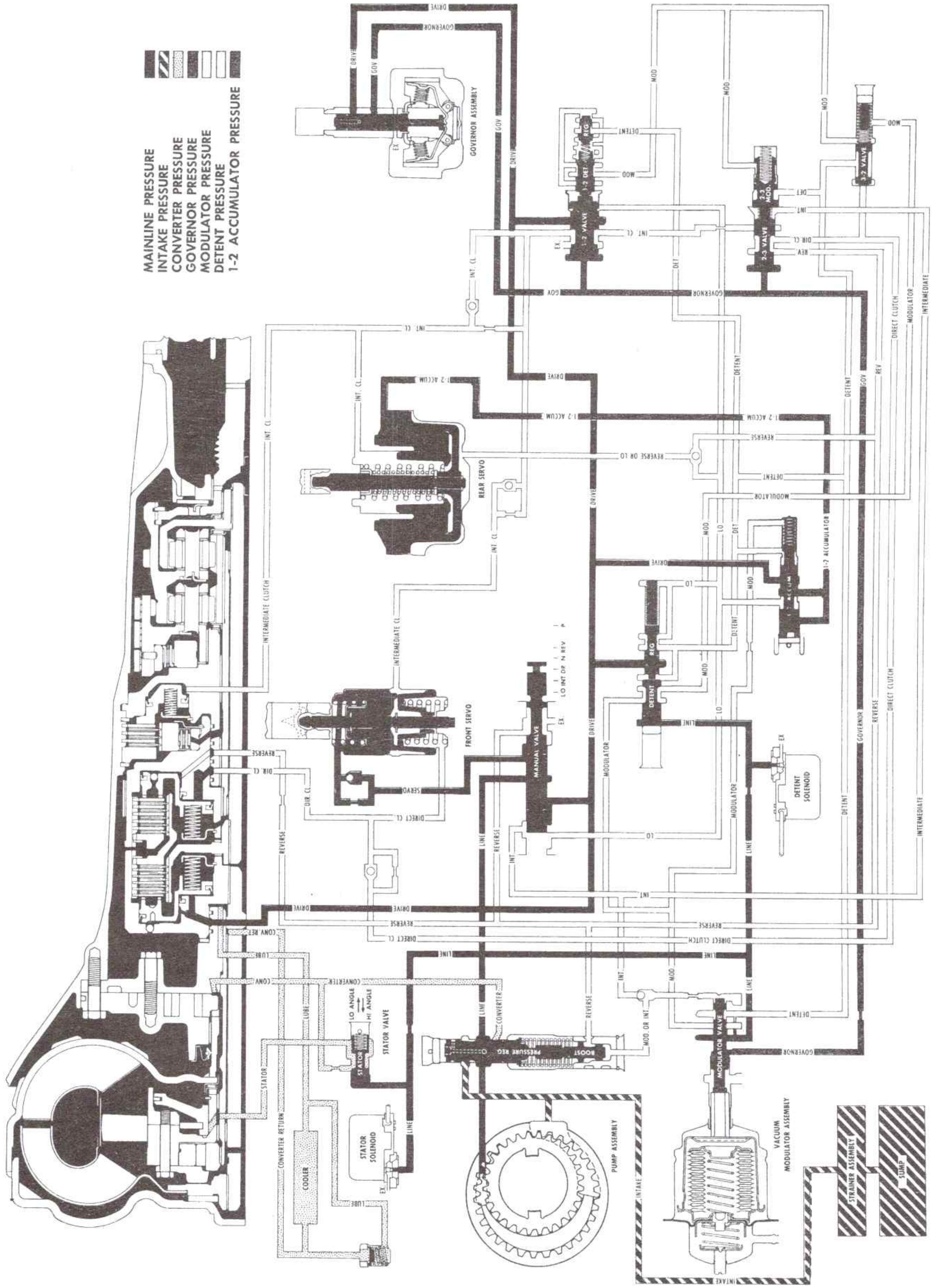


Fig. 7-8 Drive Range - First Gear

DRIVE (LEFT)—SECOND SPEED POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.48:1.

NOTE: Further reduction is possible, at low speeds, due to the torque multiplication provided by the converter.

OIL FLOW (Fig. 7-9)

As both vehicle speed and governor pressure increase, the force of governor oil acting on the 1-2 shift valve will overcome the force of regulated modulator oil pressure. This allows the 1-2 shift valve to open, permitting drive oil to enter the intermediate clutch passage.

Intermediate clutch oil from the 1-2 shift valve is directed to the:

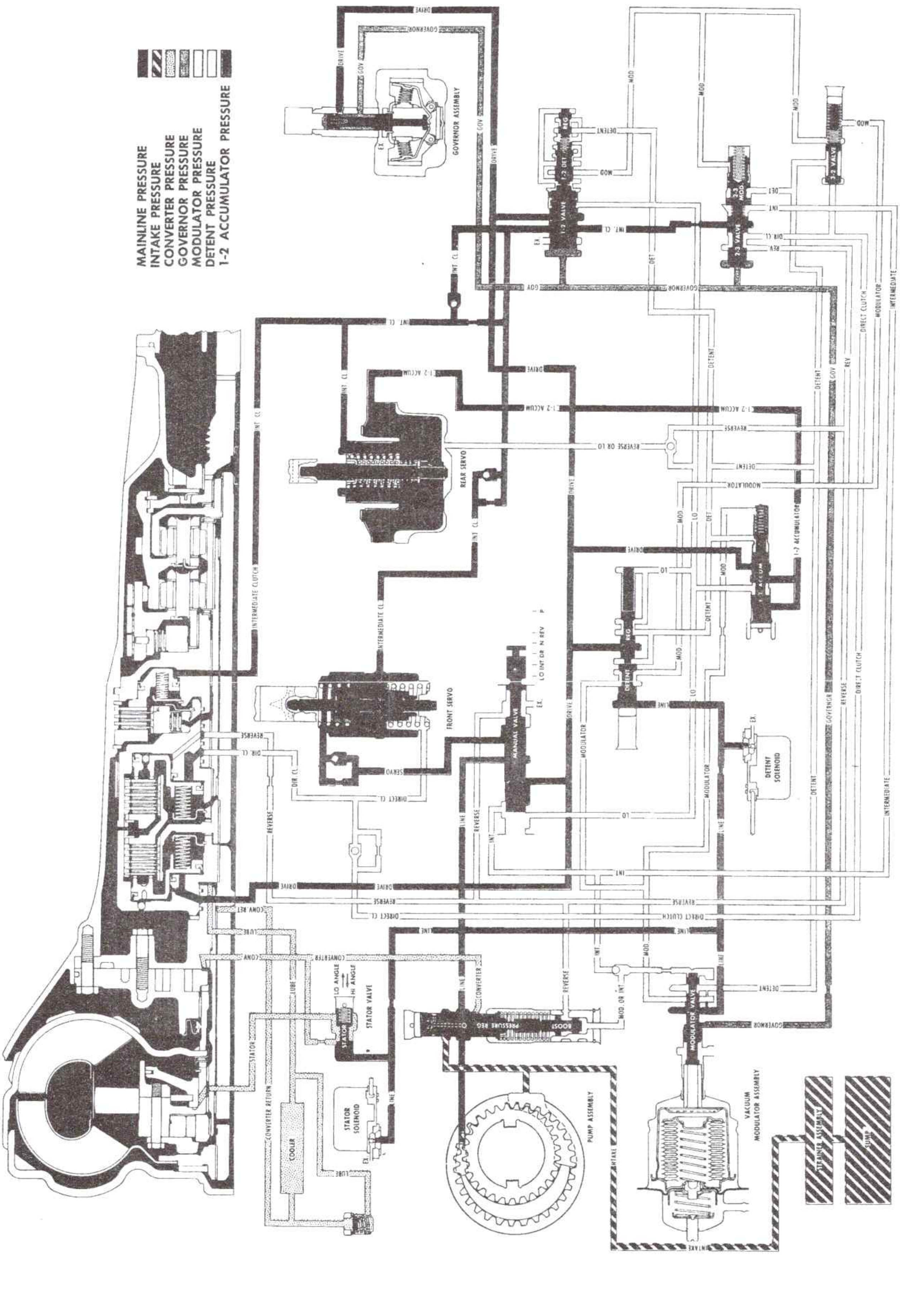
1. Intermediate Clutch
2. Rear Servo
3. Front Servo and Accumulator Pistons
4. 2-3 Shift Valve

Basic Control

Intermediate clutch oil from the 1-2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1-2 accumulator oil and accumulator spring to maintain lower pressure in the clutch during a 1-2 shift for a smooth clutch apply. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to a land of the 2-3 shift valve.

Summary

The forward and intermediate clutches are applied. The transmission is in second speed.



CADILLAC 1965

Fig. 7-9 Drive (Left) - Second Gear

DRIVE (LEFT)—THIRD SPEED POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Applied

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Ineffective

In direct drive, engine torque is transmitted from the converter, through the forward clutch to the mainshaft and rear internal gear. Because the direct clutch is applied, equal power is also transmitted to sun gear shaft and sun gear. Since both sun gear and internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive or a ratio of 1:1.

OIL FLOW (Fig. 7-10)

As vehicle speed and governor pressure increase, force of governor oil acting on the 2-3 shift valve overcomes the force of 2-3 shift valve spring and modulator oil. This allows the 2-3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage.

Direct clutch oil from the 2-3 shift valve is directed to the:

1. Direct Clutch

2. Front Accumulator Piston

3. 3-2 Valve

Basic Control

Direct clutch oil from the 2-3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch. Simultaneously, direct clutch oil is fed to the front accumulator piston. Pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch apply.

Direct clutch oil is also supplied to the 3-2 valve to move the valve against modulator pressure. This cuts off modulator oil to the 1-2 regulator and 2-3 modulator valves and allows the transmission to utilize the torque multiplying characteristics of the variable pitch converter.

Stator Blade Angle (All AA Transmissions)

When the stator solenoid is activated, line oil acting on the solenoid and stator valve is exhausted at the solenoid. The stator valve spring will move the stator valve cutting off converter oil to the stator piston. Converter charge pressure will move the stator piston, putting the stator blades at high angle.

Summary

The forward, intermediate and direct clutches are applied. The transmission is in third gear (direct drive.)

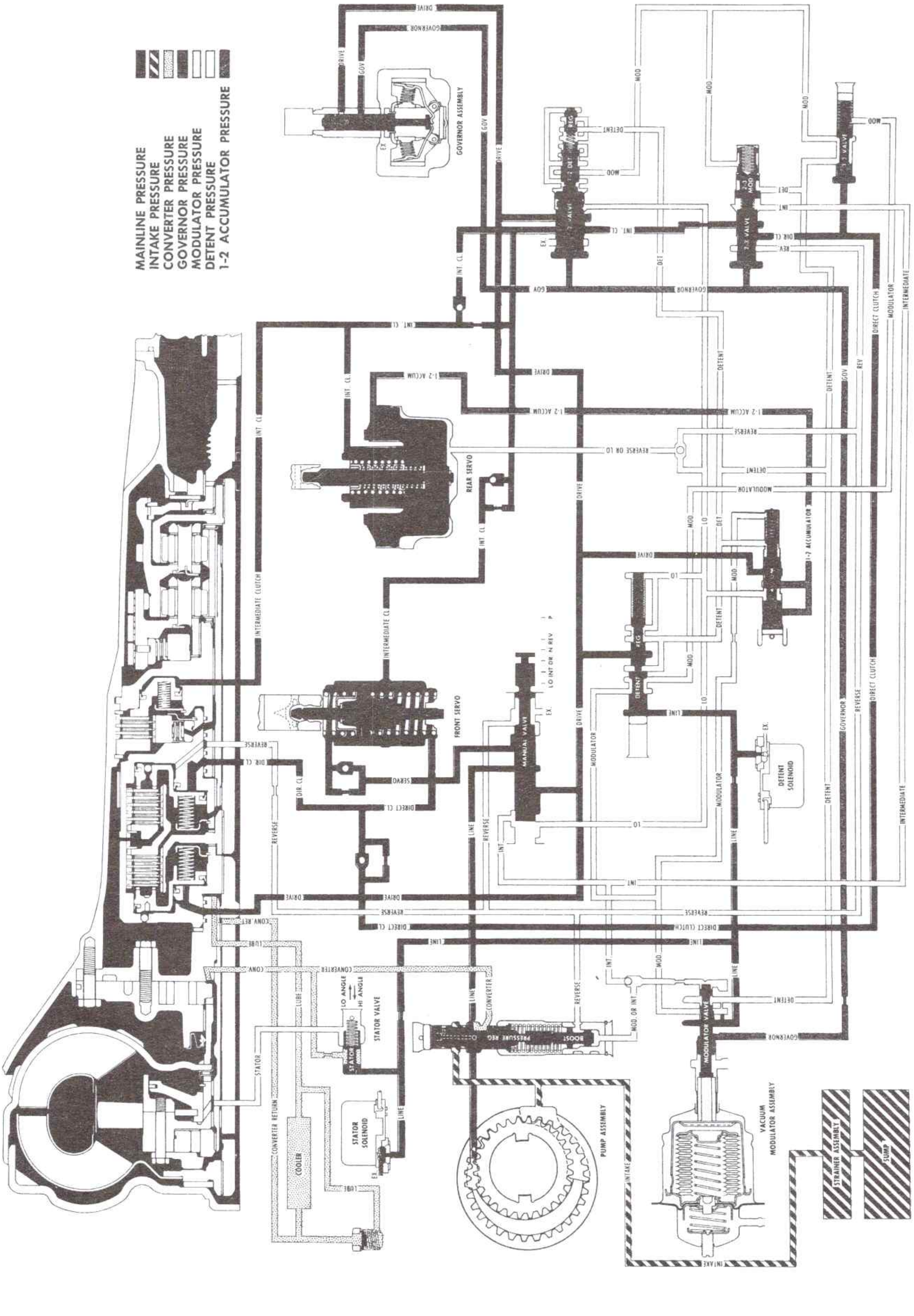


Fig. 7-10 Drive (Left) - Third Gear

PART THROTTLE 3-2 DOWNSHIFTS POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released in 2nd

Direct Clutch - Applied in 3rd

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective in 2nd

Intermediate Sprag - Ineffective in 3rd

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.48:1.

OIL FLOW (Fig. 7-11)

A part throttle 3-2 downshift can be accomplished below approximately 33 mph by depressing the accelerator far enough to raise modulator pressure to approximately 87 psi. Modulator pressure and the 3-2 valve spring will move the 3-2 valve against direct clutch oil and allow modulator oil to act on the 2-3 modulator valve. This moves the 2-3 valve train against governor oil and shifts the transmission to second speed.

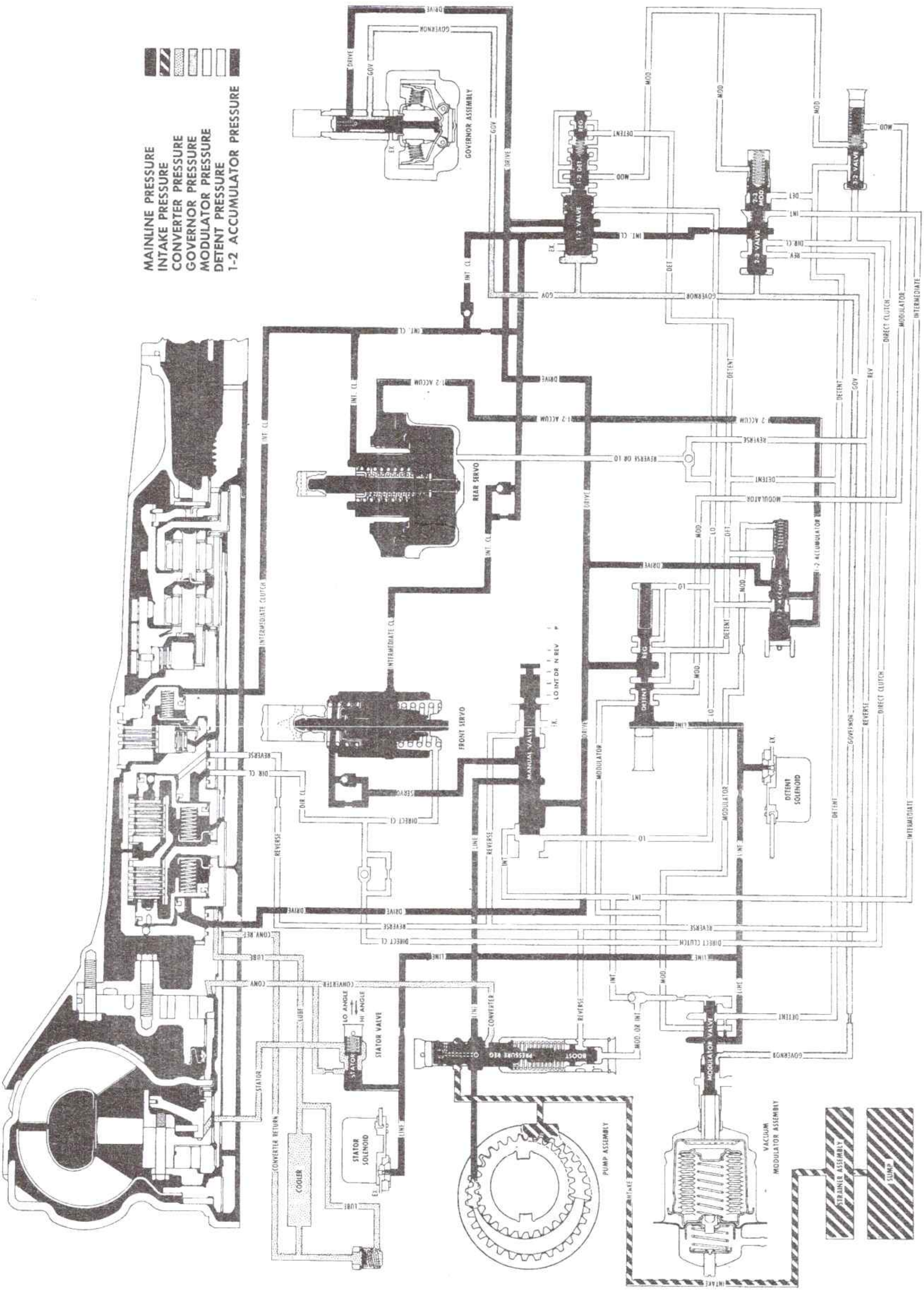


Fig. 7-11 Part Throttle 3-2 Downshift

DETENT 3-2 DOWNSHIFT POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released in 2nd

Direct Clutch - Applied in 3rd

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective in 2nd

Intermediate Sprag - Ineffective in 3rd

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.48:1.

OIL FLOW (Fig. 7-12)

While operating at speeds below approximately 70 mph a forced or detent 3-2 downshift is possible by depressing the accelerator to 60° throttle opening. This energizes the switch at the carburetor and actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a small orifice.

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 70 psi and called detent oil. Detent oil is then routed to the:

1. Modulator passage
2. 1-2 Regulator Valve
3. 2-3 Modulator Valve
4. 3-2 Valve
5. 1-2 Accumulator Valve
6. Vacuum Modulator Valve

Detent oil in the modulator passage and at the 2-3 modulator valve will close the 2-3 shift valve, shifting the transmission to second gear.

Detent 2-1 Downshift

A detent 2-1 downshift can also be accomplished below approximately 20 mph because detent oil is directed to the 1-2 regulator valve. This allows detent oil to act on the 1-2 regulator, and 1-2 detent valve to close the 1-2 shift valve, shifting the transmission to first gear.

Detent oil is also directed to the modulator valve to prevent modulator pressure from regulating below 70 psi at high speeds or at high altitudes.

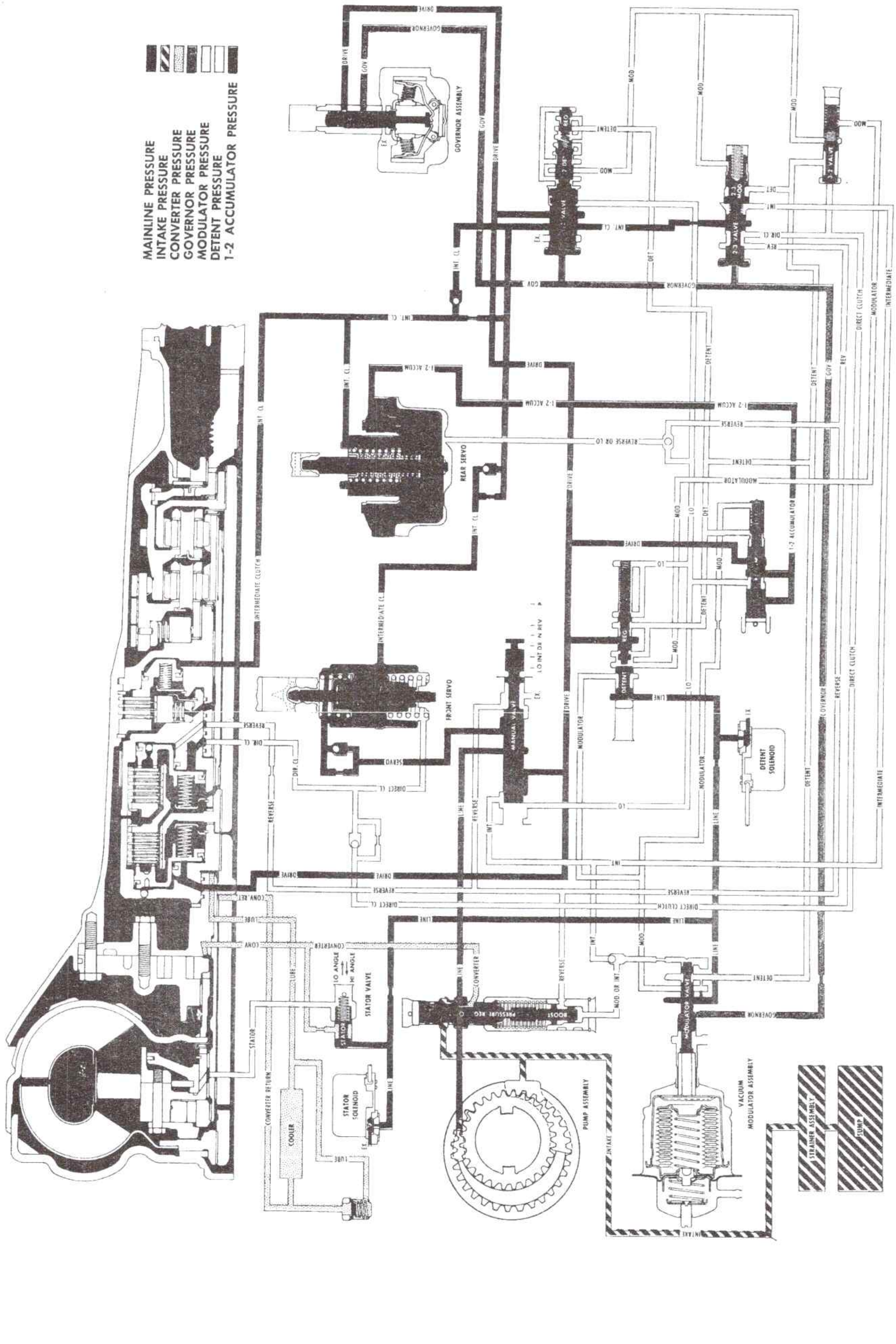


Fig. 7-12 Detent 3-2 Downshift

DRIVE (RIGHT)—SECOND SPEED POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released

Front Band - Applied

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.48:1.

In second speed - Drive (right), engine braking is provided by the front band as it holds the sun gear fixed. Without the band applied, the sun gear would overrun the intermediate sprag.

OIL FLOW (Fig. 7-13)

When the selector lever is in Drive (right), intermediate oil from the manual valve is directed to the:

1. Pressure Boost Valve
2. 2-3 Shift Valve

Intermediate oil at the boost valve will increase line pressure to 150 psi. This increased intermediate oil pressure at the 2-3 shift valve will close the 2-3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second speed - Drive (right), it cannot upshift to third gear.

Summary

The forward and intermediate clutches and front band are applied. The transmission is in second gear - Drive (right).

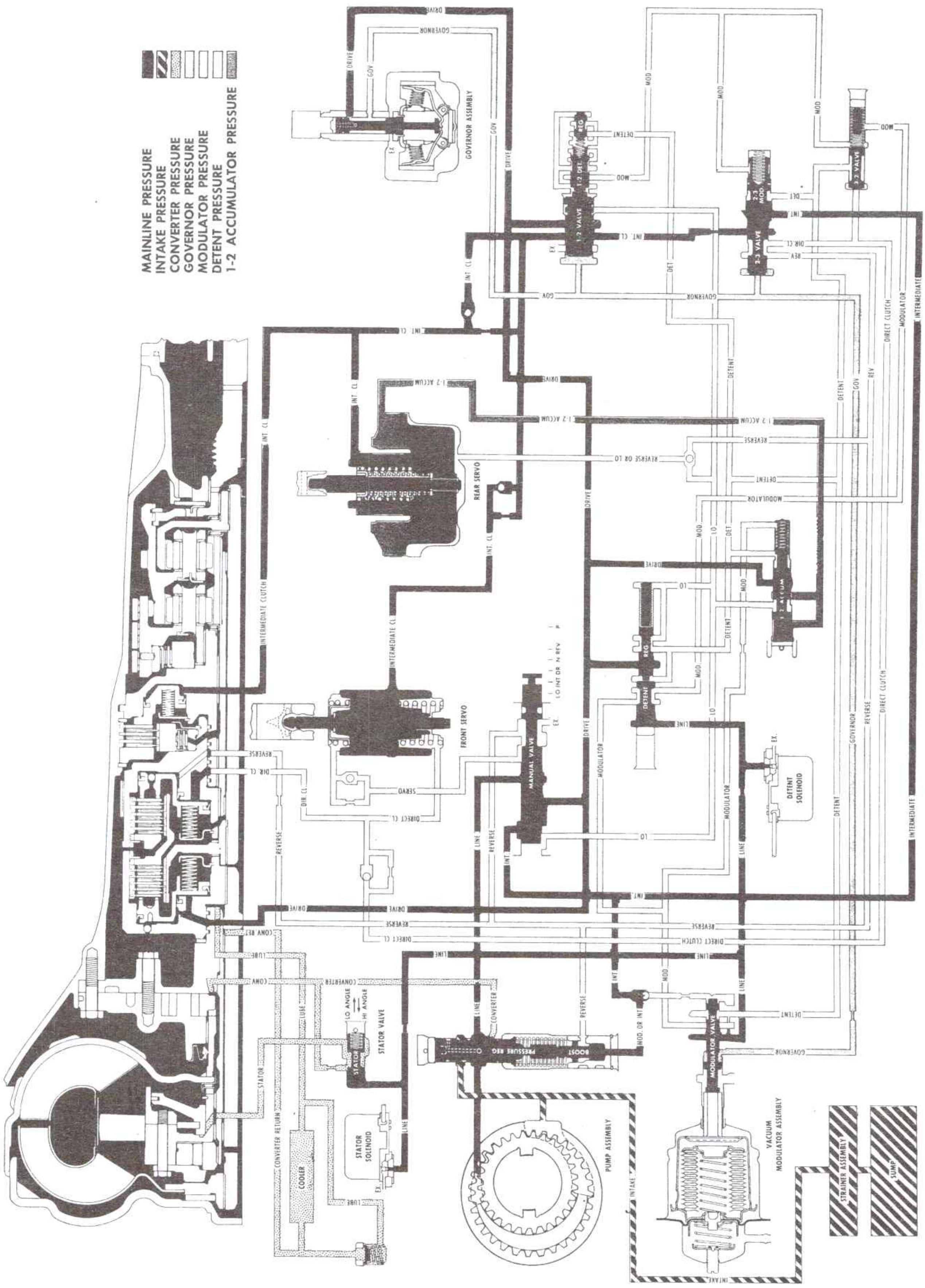


Fig. 7-13 Drive (Right) - Second Gear

LO RANGE—FIRST SPEED POWER FLOW

Forward Clutch - Applied

Roller Clutch - Effective

Direct Clutch - Released

Front Band - Released

Rear Band - Applied

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

With the selector lever in Lo range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear in a clockwise direction. (Converter torque ratio = approximately 2.00:1 at stall.)

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear counterclockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.48:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and roller clutch assembly to the transmission case. (Total stall ratio = approximately 5.00:1.)

Downhill or overrun braking is provided in Lo range by applying the rear band, as this prevents the reaction carrier from overrunning the roller clutch.

OIL FLOW (Fig. 7-14)

Maximum downhill braking can be attained at speeds below 40 mph, with the selector lever in Lo position as this directs Lo oil from the manual valve to the:

1. Rear Servo

2. 1-2 Accumulator Valve

3. Detent Regulator Valve

Basic Control

Lo oil flows past a ball check to the apply side of the rear servo piston and to the 1-2 accumulator valve to raise the 1-2 accumulator oil to line pressure for a smooth band apply.

Lo oil acts on the detent regulator valve. Combined with the detent spring, Lo oil holds the detent valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1-2 regulator and 1-2 detent valve overcomes governor oil on the 1-2 shift valve at any vehicle speed below approximately 40 mph, and the transmission will shift to first gear.

In first speed - Lo range, the transmission cannot upshift to second speed regardless of vehicle or engine speed.

Summary

The forward clutch and rear band are applied. The transmission is in first speed - Lo range.

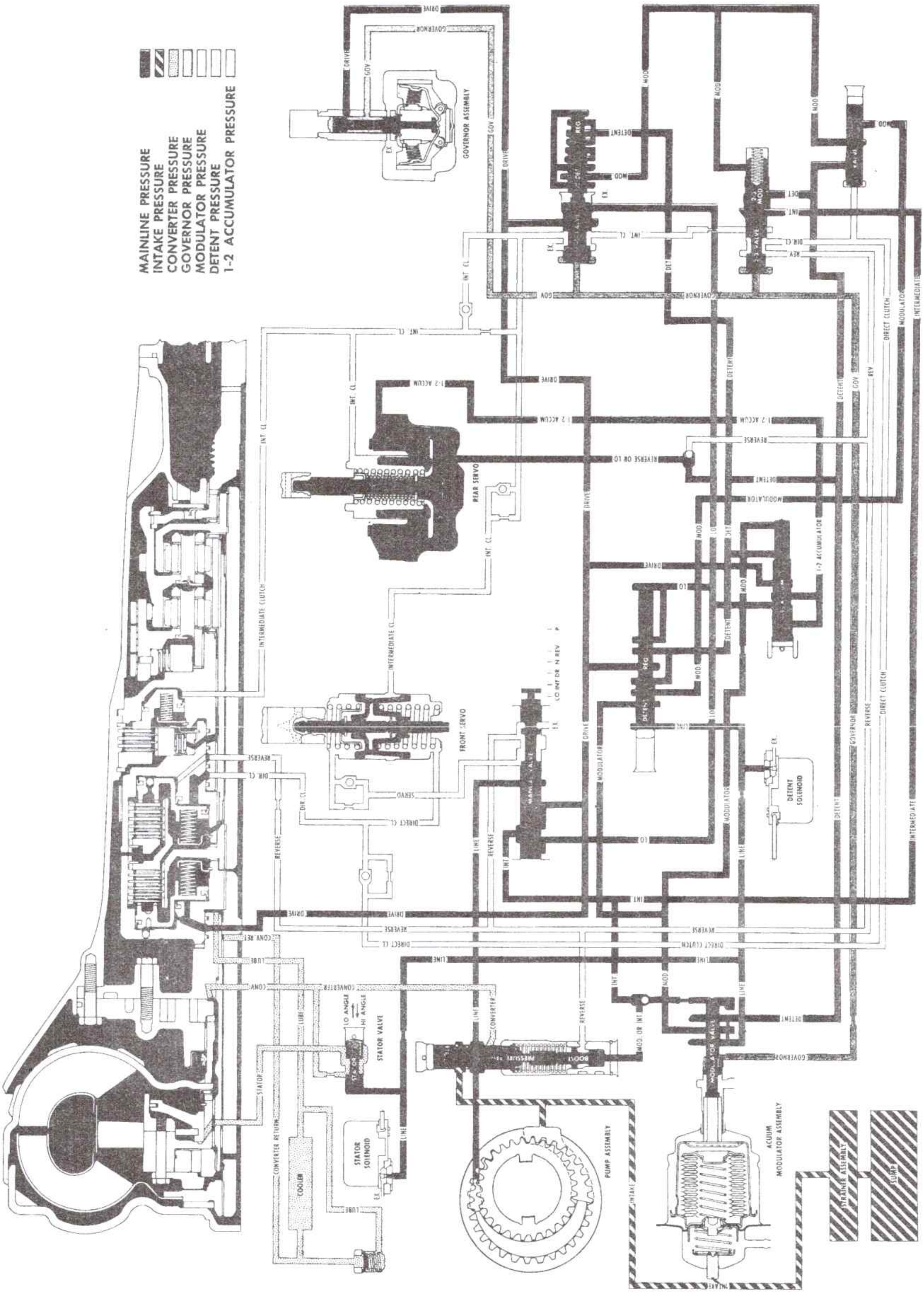


Fig. 7-14 Lo Range - First Gear

REVERSE
POWER FLOW

Forward Clutch - Released

Roller Clutch - Ineffective

Direct Clutch - Applied

Front Band - Released

Rear Band - Applied

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

In Reverse, the direct clutch is applied to direct turbine torque to the sun gear shaft and sun gear. The rear band is also applied, holding the reaction carrier.

Clockwise torque to the sun gear causes the front pinions and front internal gear to turn counterclockwise in reduction. The front internal gear is connected directly to the output shaft, thus providing the reverse output gear ratio of approximately 2.08:1. The reverse torque multiplication at stall (converter and gear ratios) is approximately 4.00:1.

OIL FLOW (Fig. 7-15)

When the selector lever is moved to the Reverse position, the manual valve is repositioned to allow line pressure to enter the reverse circuit. Reverse oil then flows to the:

1. Direct Clutch
2. 2-3 Shift Valve
3. Rear Servo Piston
4. Pressure Boost Valve

Basic Control

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2-3 shift valve. From the 2-3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply direct clutch.

Reverse oil flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil also acts on the pressure boost valve to boost line pressure.

Summary

The direct clutch and the rear band are applied. The transmission is in Reverse.

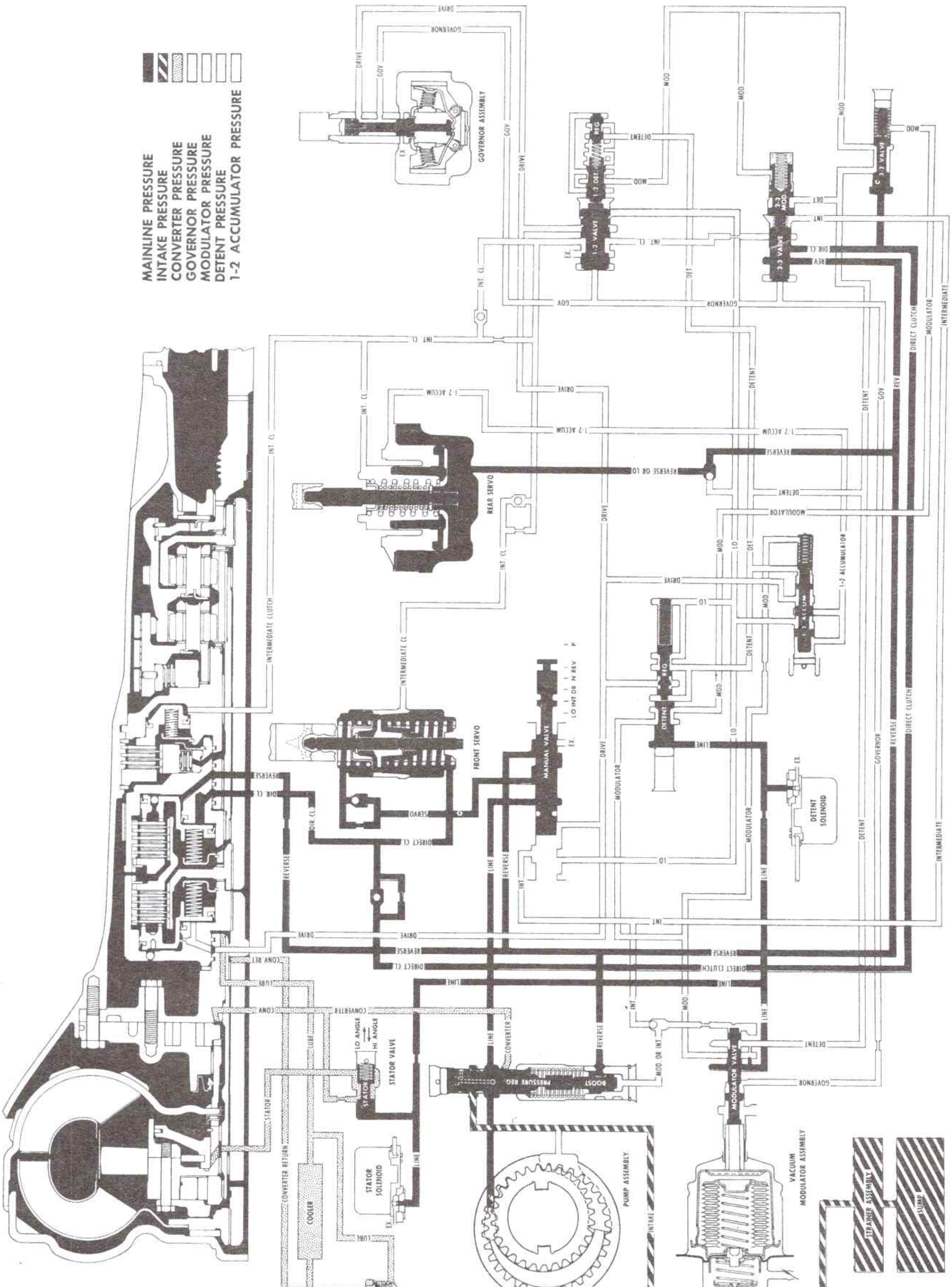
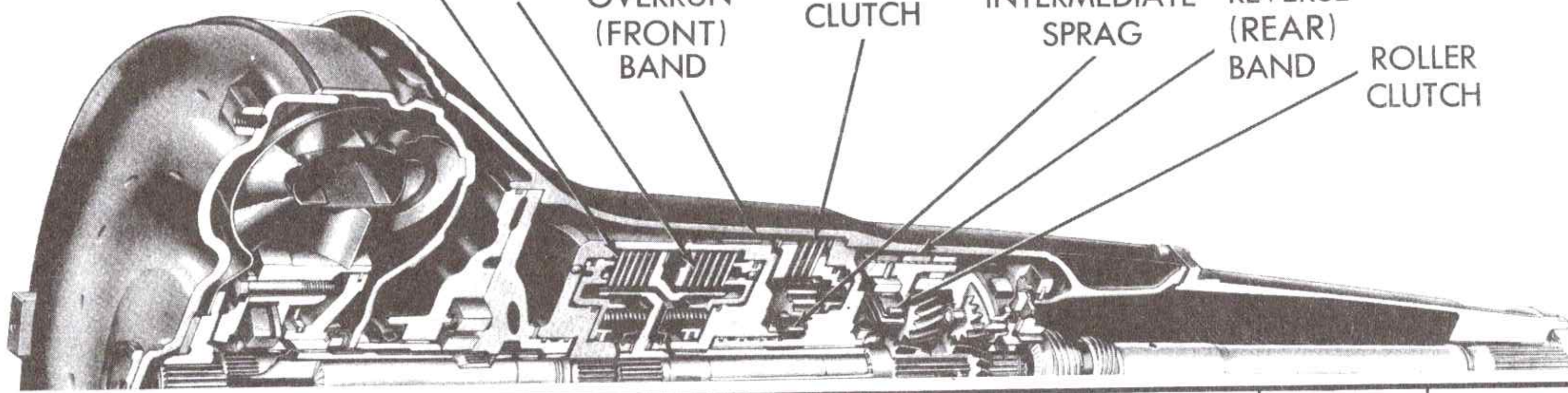


Fig. 7-15 Reverse



SELECTOR POSITION	PUMP PRESSURE	FORWARD CLUTCH	DIRECT CLUTCH	2ND OVERRUN BAND	INT. CLUTCH	INT. SPRAG	ROLLER CLUTCH	REV. BAND
PARK—NEUT.	70-150	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DRIVE 1 LEFT 2 3	70-150 70-150 70-150	ON ON ON	OFF OFF ON	OFF OFF OFF	OFF ON ON	OFF ON OFF	ON OFF OFF	OFF OFF OFF
DRIVE 1 RIGHT 2	150 150	ON ON	OFF OFF	OFF ON	OFF ON	OFF ON	ON OFF	OFF OFF
LO 1 2	150 150	ON ON	OFF OFF	OFF ON	OFF ON	OFF ON	ON OFF	ON OFF
REV.	100-230	OFF	ON	OFF	OFF	OFF	OFF	ON

Fig. 7-16 Band, Sprag and Clutch Application Chart

SERVICE INFORMATION

NOTE: The following information, unless specifically noted elsewhere, is not applicable to the Fleetwood Eldorado.

1. Turbo Hydra-Matic Diagnosis

Accurate diagnosis of transmission problems begins with a thorough understanding of normal transmission operation. In particular, knowing which units are involved in the various speeds or shifts, is essential so that the specific units or circuits can be isolated and further investigated.

a. Fluid Level	n. Stator Circuitry
b. Oil Pressure	o. Stator Solenoid
c. Manual Linkage	p. Forward Clutch
d. Engine Idle Speed and Air Mixture	q. Intermediate Clutch and Sprag
e. Vacuum Line	r. Direct Clutch
f. Vacuum Modulator Assembly	s. Front Band
g. Transmission Downshift Switch	t. Rear Band
h. Detent Solenoid	u. Roller Clutch
i. Governor	v. Case Assembly
j. Control Valve Assembly	w. Turbine Shaft
k. Rear Servo and Accumulator Assembly	x. Pump Assembly
l. Front Servo and Accumulator Assembly	y. Converter Assembly
m. Strainer Assembly	z. Gears and End Play

Fig. 7-17 Diagnosis Sequence Chart

The Diagnosis Sequence Chart shown in Fig. 7-17 lists the various diagnosis operations in the sequence in which they are to be performed. Following the chart may correct the condition, without requiring removal of the transmission. Instructions must be followed in exact sequence as any deviation will result in incorrect diagnosis.

The Diagnosis Guide, Fig. 7-18, has been developed to assist in diagnosing Turbo Hydra-matic transmission conditions, and is intended for use in conjunction with the diagnosis sequence chart.

The following diagnosis procedures should be used only on 1967 Turbo Hydra-matic transmissions. They do not apply to any other transmissions.

CONDITION	POSSIBLE CAUSE
No Drive In Drive Range	a, b, c, j, m, p, u, v, x, z
1-2 Shift - Full Throttle Only	e, f, g, h, j, v
First Speed Only, No 1-2 Shift	h, i, j, q, v
First and Second Speeds Only, No 2-3 Shift	i, j, l, r, v
Drive in Neutral	c, p
No or Slipping Reverse	a, b, c, j, k, r, t, v
Slipping - All Ranges or on Start	a, b, e, f, m, p, v, x, y
Slipping 1-2 Shift	a, b, e, f, j, k, l, q, v, x
Rough 1-2 Shift	a, b, e, f, j, k, v, x
Slipping 2-3 Shift	a, b, e, f, j, l, r
Rough 2-3 Shift	b, e, f, l, r
No Engine Braking - Drive Right, Second Gear	l, s
No Engine Braking - Lo, First Gear	j, k, t
No Part Throttle Downshift	b, e, f, j
No Detent Downshifts	g, h, j
Low or High Shift Points	b, e, f, g, h, i, j, n, o, v, y
Will Not Hold In Park	c
No Converter Stator Angle Change	g, n, o, v, w, x, y
Transmission Noise	b, x, y, z

Fig. 7-18 Diagnosis Guide

Perform the following preliminary checks in preparation for shift point check and then continue with diagnosis.

1. Check fluid level and correct if necessary.

2. Make certain engine and transmission are at normal operating temperature.

3. Make certain selector lever moves freely in all positions and that pointer on indicator quadrant is correctly aligned.

4. Check manual linkage and adjust if necessary, Note 4.

5. Check transmission downshift switch and adjust if necessary, Notes 5 and 6.

6. Road test the car using all selector ranges noting when discrepancies in operation occur. Check shift pattern as follows:

a. Drive (left) - Position selector lever in Drive (left), accelerating the vehicle from 0 mph. A 1-2 and 2-3 shift should occur at all throttle openings. (The shift points will vary with the throttle opening). As the vehicle decreases in speed to 0 mph, the 3-2 and 2-1 shifts should occur.

b. Drive (right) - Position the selector in Drive (right) and accelerate from 0 mph. A 1-2 shift should occur at all throttle openings. (No 2-3 shift can be obtained in this range.) The 1-2 shift point will vary with throttle opening. As the vehicle decreases in speed to 0 mph, a 2-1 shift should occur.

c. Lo range - Position the selector lever in Lo range. No upshift should occur in this range regardless of throttle opening.

d. 2nd gear overrun braking - Position the selector lever in Drive (left), at approximately 35 mph move the selector lever to Drive (right). The transmission should downshift to 2nd. An increase in engine rpm and an engine braking effect should be noticed.

e. 1st gear - downhill or overrun braking - With the selector lever in Drive (right) at approximately 30 mph, but not over 40 mph, at constant throttle, reposition the selector lever into Lo range. An increase in engine rpm and a braking effect should be noticed.

f. Stator Shift - Above 40° throttle opening - With selector lever in Drive (right) accelerate in 2nd gear on a slight incline. A shift of the stator should be felt on all AA transmissions.

a. Fluid Level

Before attempting to check or correct any transmission complaint, it is essential that fluid level be checked and corrected if necessary. Either too high or too low an oil level can cause slippage in all ranges or excessive noise.

Fluid level should be checked with the selector lever in Park position, engine operating at slow idle, and vehicle on a level surface. Transmission oil should be at operating temperature (170°F.). If fluid level is low, add sufficient fluid to bring to proper level as described in Note 7b.

b. Oil Pressure

Oil pressure can be checked with transmission in car using 0-300 psi Pressure Gage, J-5907.

1. Clean dirt from line pressure plug, located on left side of transmission case, and remove plug.

2. Connect pressure gage hose fitting at pressure plug bore in transmission case, Fig. 7-19, and place gage in car so that it can be seen from driver's seat. Refer to Fig. 7-16.

3. Drive car until transmission oil has reached operating temperature (170°F.).

4. Check and correct fluid level if necessary.

5. The following check may be made by road test:

a. Engine Idle Pressure Check:

1. Place selector lever in Drive (Left) and operate car at approximately 30 mph, with throttle closed. Line pressure should be 70 psi.

2. Place selector lever in Drive (Right) and operate car at steady road load, 25 mph. Line pressure should be 150 (±5) psi.

b. Full Throttle Pressure Check

With car on jack stands, disconnect vacuum line from carburetor and place selector lever in Neutral and in Reverse. Operate engine at fast idle (700 - 1000 rpm) in each position. Neutral pressure should be 145 psi and Reverse pressure 230 psi. Connect vacuum line.

If either pressure check was low, check vacuum modulator assembly for loose attaching bolt, collapsed bellows, or stuck modulator valve. Also check pressure regulator valve and spring for sticking, plugged orifice, or collapsed spring. Check regulator boost valve for sticking.

If either pressure check was high, check vacuum line and check vacuum modulator for leaks or sticking valve. Also check pressure regulator valve and boost valve for sticking.

c. Manual Linkage

Manual linkage adjustment and the associated neutral safety switch are important safety factors.

Check manual linkage and adjust if necessary, as described in Note 4. Make certain that indicator pointer indexes in Drive position when

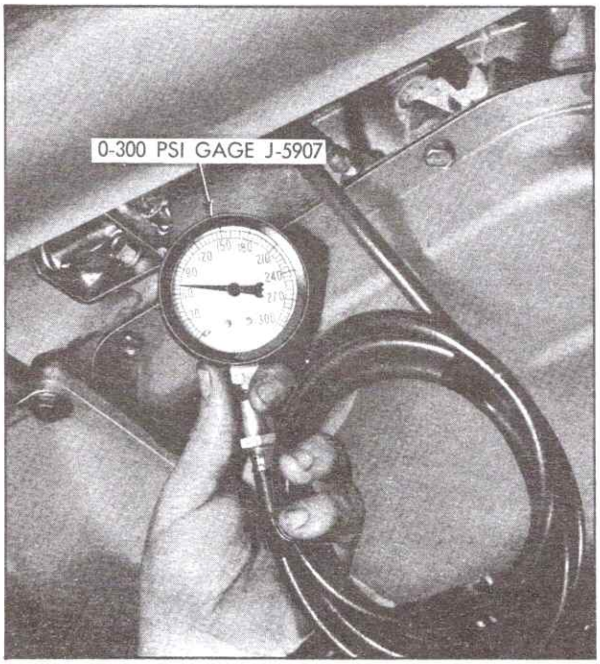


Fig. 7-19 Checking Oil Pressure

selector lever is at drive stop. Pointer should line up properly with all range indicators in selector quadrant. When selector lever is in Park position, parking pawl should prevent vehicle from rolling.

The neutral safety switch (integral with the back-up light switch and parking brake vacuum release valve) should be adjusted so that the engine will start only in Park and Neutral. Back-up lights should operate when selector lever is placed in Reverse. Parking brake should release in any drive range with engine running. The procedure for adjusting this switch is described in Section 12, Note 25.

d. Engine Idle Speed and Air Mixture Adjustment

Specific instructions for adjustment are described in Section 6, Note 88.

e. Vacuum Modulator Vacuum Line

Check Vacuum Line for:

1. Leaks

2. Restriction in line

3. Crimped line

4. Plugged or leaking intake manifold fitting.

f. Vacuum Modulator Assembly

The vacuum modulator assembly controls transmission line pressure. A fault in the vacuum modulator assembly, such as a leaking diaphragm, bellows, or a stuck modulator valve, or a malfunction in the vacuum line (Note e), may cause:

1. High line pressure

2. Low line pressure

3. High shift points

4. Low shift points

5. Harsh shifts

6. Slipping shifts

g. Transmission Downshift Switch

The transmission downshift switch and detent and stator solenoids can be checked by listening for the solenoids to click while operating the switch by hand. Stator solenoid is energized first. If the solenoids did not energize:

1. Check electrical connections.

2. Check adjustment of transmission downshift switch as described in Note 5.

3. Check downshift switch circuitry as described in Note 6.

h. Solenoids

1. Tested in Note G.

2. Replace the solenoid.

If the solenoid did engage, but the shift points were late, check:

1. For loose solenoid attaching screws.

2. For mispositioned solenoid gasket.

3. For plugged solenoid orifice.

4. For a leak between control valve assembly spacer plate and case. This could be caused by a bent spacer, damaged gasket or uneven case face surface.

i. Governor Assembly

The governor assembly controls the transmission shift points. A stuck governor can cause:

1. No upshift.

2. Second or third gear start.

3. Low or high line pressure.

j. Control Valve Assembly

The control valve assembly check involves disassembly and thorough inspection of the unit as described in Note 17h, with particular attention to the following items:

1. Screws

Attaching screws must not be loose or excessive leakage will occur between the adjacent channels. Over-torquing the screws can cause distortion or warping which also causes leakage and sticking valves.

2. Distorted or Mispositioned Springs in Valve Body

The position and condition of the springs is important. The exact number of springs and their locations are shown in Fig. 7-50.

3. Sticky Valves

The valves should be free enough in their bores to fall of their own weight. Burrs or small dents can be removed with a fine abrasive stone. The sharp edges of the valve lands should not be removed.

4. Porosity

Porosity between channels or passages can be detected by using a solvent and observing if any leakage occurs.

5. Valve Body or Case

The valve body and case must be flat or cross leakage can occur.

A surface plate and bluing is useful in checking for out of flat conditions of the valve body. Gentle and careful lapping of the valve body sealing faces will often correct an out of flat condition. Check spacer plate for dents or nicks.

k. Rear Servo and Accumulator Assembly

The rear servo applies the rear band in Reverse, and Lo range-first gear. It also is the accumulator for the 1-2 shifts. A faulty rear servo, such as a leaking accumulator or servo piston oil seal, a stuck piston, or wrong piston pin or a broken or missing spring can cause:

1. Slipping 1-2 shift.

2. Harsh 1-2 shift.

3. Slipping reverse.

4. No reverse.

5. No overrun braking in Lo range.

l. Front Servo and Accumulator Assembly

The front servo applies the front band in drive (right) second gear for overrun braking. It also acts as an accumulator. A faulty servo, such as a broken oil seal ring, a stuck piston or a broken or missing spring may cause:

1. Slipping 1-2 shift.

2. Slipping 2-3 shift.

3. No engine braking in drive (right), second gear.

4. Harsh 2-3 shift.

5. Slipping reverse.

m. Strainer Assembly

A plugged or broken strainer assembly can cause:

1. Slipping in all ranges or starts.

2. No drive in drive.

n. Stator Circuitry and
o. Stator Solenoid

The variable pitched stator is energized by the transmission downshift switch above 40° and below 6° of throttle opening. Check circuitry as described in Note 6.

p. Forward Clutch

The forward clutch is the connection between the converter and the transmission gear set and is applied in all forward driving ranges.

Slipping first gear or no forward drive may be caused by:

1. Missing or broken pump oil seal ring.

2. Leaking inner or outer piston seal.

3. Check ball stuck.

4. Clutch plates worn.

q. Intermediate Clutch

The intermediate clutch is applied in second gear, which makes the sprag effective in holding the sun gear shaft and sun gear from turning counterclockwise.

A slipping 1-2 shift or no second gear may be caused by:

1. Leaking piston seals.

2. Worn clutch plates.

3. Loose case to center support bolt.

r. Direct Clutch

The direct clutch is applied in third gear and reverse to drive the sun gear clockwise.

A slipping 2-3 shift, slipping reverse, no third gear, or no reverse, may be caused by:

1. Leaking piston seals.

2. Check ball stuck or missing.

3. Broken or missing case support oil seal rings.

4. Worn clutch plates.

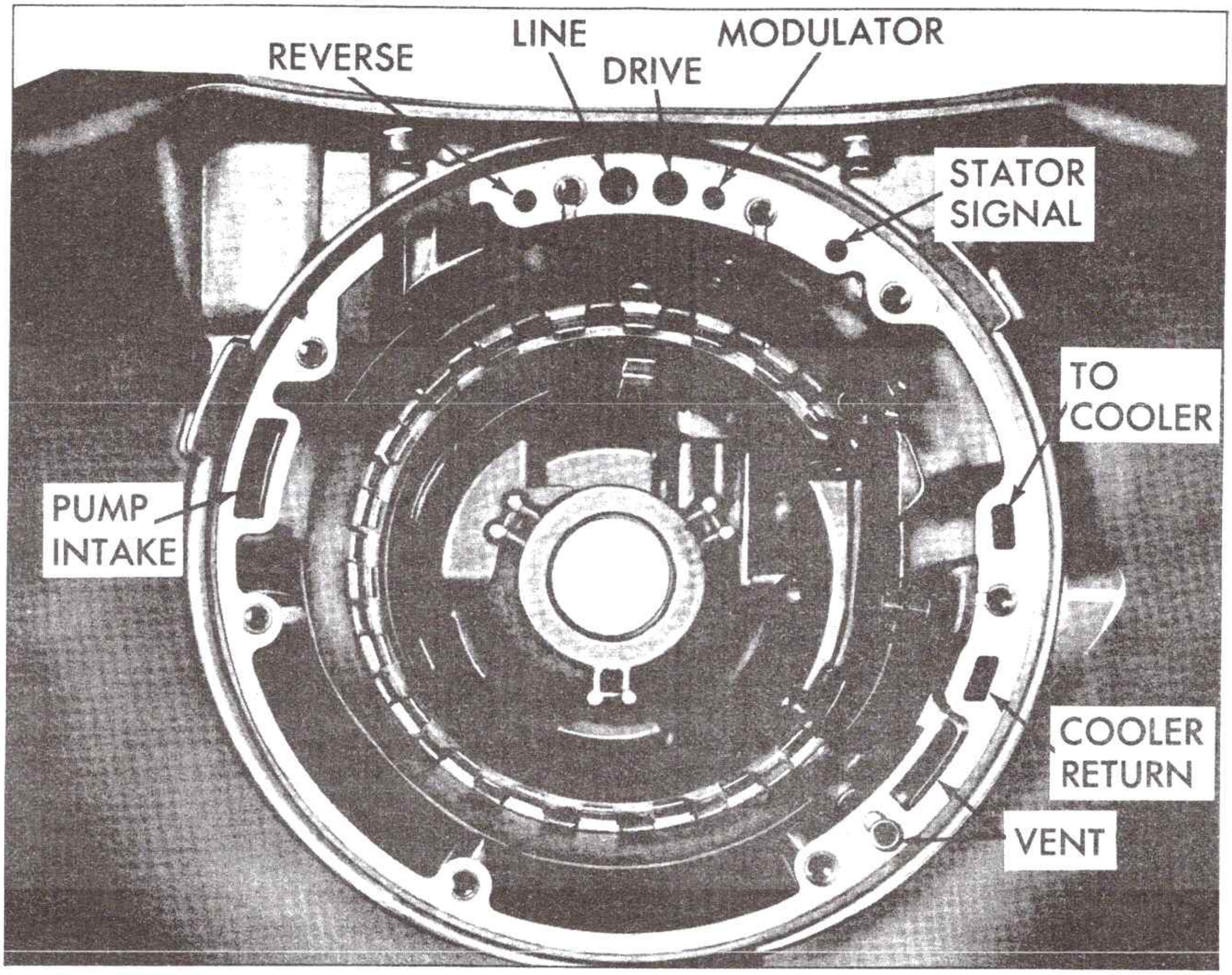


Fig. 7-20 Transmission Case Oil Passages - Front View

5. Loose case to center support bolt.

s. Front Band and
t. Rear Band

The front and rear bands are used to reinforce the sprag or roller clutch for engine braking.

A broken or burnt front band will cause no second gear overrun braking in drive right. A broken or burnt rear band will cause no first gear engine braking in Lo range, and no Reverse.

u. Roller Clutch

The roller clutch acts to hold the reaction carrier to obtain first gear reduction. If slipping, a slipping start, or no drive is noted, check the roller clutch for:

1. Damaged or worn cam or race.

2. Roller clutch inoperative (rollers damaged).

3. Damaged energizing springs.

v. Case Assembly

The case assembly should be checked for:

1. Leakage - internal and external. See Note 3c.

2. Blocked channels.

3. Plugs missing.

w. Turbine Shaft

The turbine shaft should be checked for the following:

1. Defective oil seal rings.

2. Defective ring lands.

3. Wrong shaft.

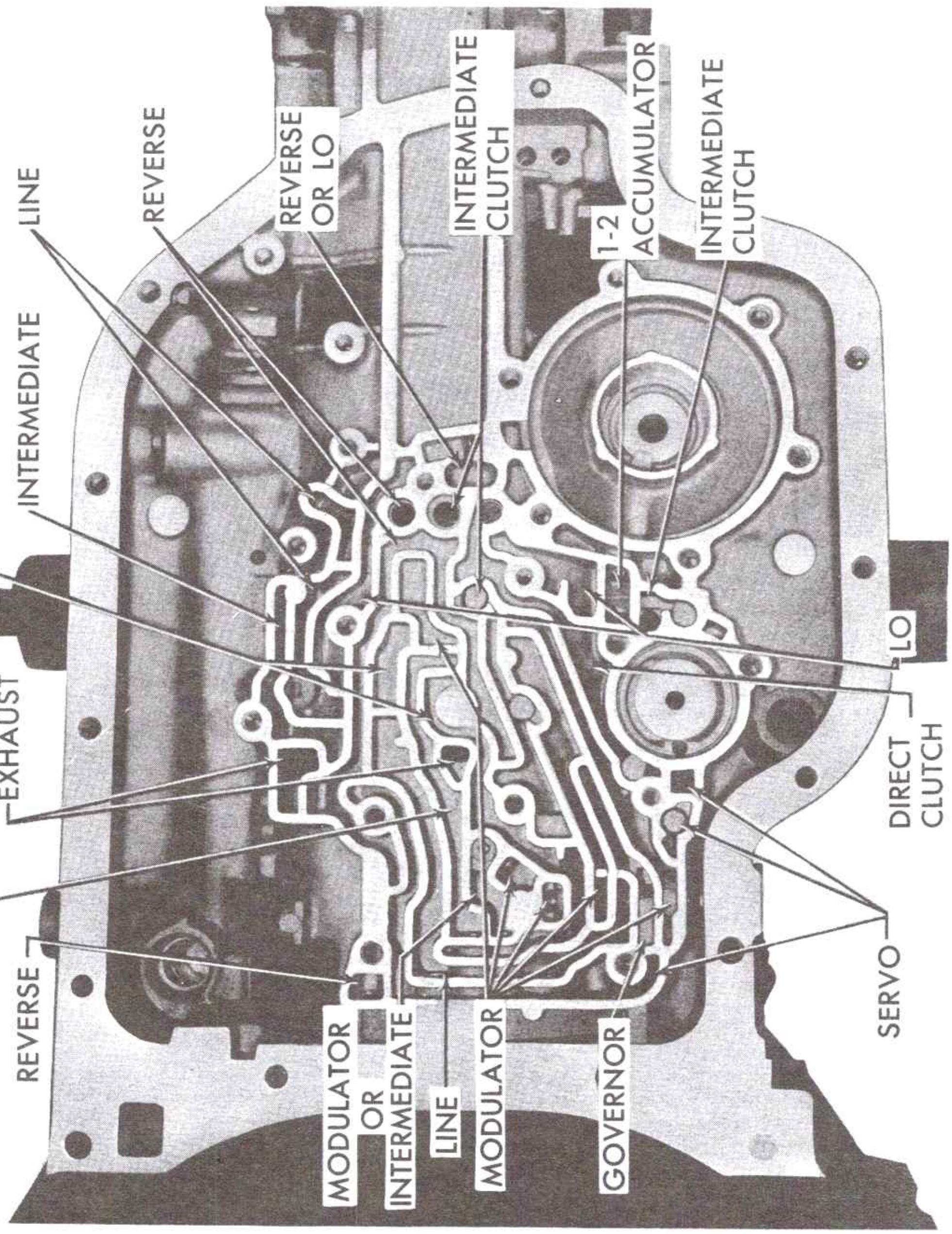


Fig. 7-21 Transmission Case Oil Passages - Bottom View

x. Pump and Pressure Regulator Assembly

The pump and pressure regulator assembly supplies operating pressure for the transmission. Defects in the pump assembly may cause:

1. No drive
2. Slipping
3. No downshifts
4. Low or high shift points
5. No stator angle change
6. Noise
7. Insufficient converter oil

y. Converter Assembly

The converter should be inspected as described in Note 15. Defects in the converter may cause:

1. No stator angle change
2. Noise

For additional information in diagnosing the Turbo Hydra-matic transmission, a chart showing the application of the bands and clutches in the various driving ranges, is shown in Fig. 7-16. Transmission case oil passages are shown in Fig. 7-20 and Fig. 7-21.

2. Fluid Leakage Precautions

The precautions that must be observed to prevent fluid leaks are as follows:

1. Use new gaskets and O-ring seals whenever there is a disassembly.

2. Use a very small amount of petrolatum to hold gaskets and thrust washers in place during assembly, or to seal gaskets. Never use gasket paste or shellac.

3. Make sure that composition cork and paper gaskets are not wrinkled or creased when installed. Make sure that gaskets have not stretched or shrunk during storage.

4. Make sure the square type O-ring seals are installed squarely and are not twisted during assembly.

5. Make sure that mating surfaces of castings are flat and smooth, free of deep scratches, chips, and burrs.

3. Points of Possible Oil Leaks

When checking for oil leaks, first determine whether leak originates from transmission or engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating leaks. If the color of the dye cannot be detected in the transmission fluid, add a red aniline dye preparation to the fluid. Red dye appearing in the leaking oil will give positive identification as to the location of the leak.

If oil leak is found to be in transmission, check for leak in following areas:

a. Front End

It will be necessary to remove lower cover at front of transmission case to determine location of leaks at front end. To correct leaks at front end, it will be necessary to remove transmission from car.

1. Pump oil seal leak - Check pump oil seal to make certain it is correctly installed and not damaged.

When installing a new pump oil seal, Note 14, make certain that bore is free from foreign material and that garter spring on seal is correctly positioned. Check finish of converter neck and bearing surface in pump body.

2. Pump assembly-to-case square cut O-ring or gasket damaged.

3. O-ring or rubber coated-washers on pump attaching screws damaged or missing.

4. Converter - Inspect converter for indications of leakage. See Note 15, for checking procedure.

b. Extension Housing

1. Extension housing oil seal not installed properly or damaged.

2. Gasket (extension housing-to-case) improperly installed or damaged.

3. Extension housing-to-case attaching screws not torqued to specifications. Tighten to 23 foot-pounds.

4. Porous or cracked casting.

5. Plug in propeller shaft front slip yoke loose or leaks on 697 or 698 series cars.

6. O-ring on output shaft, on AA and AC transmissions, improperly installed or damaged.

c. Transmission Case

1. Speedometer driven gear housing retainer attaching screw loose. Tighten to 18 foot-pounds.

2. Speedometer driven gear housing O-ring or lip seal damaged.

3. Governor cover attaching screws not tight. Tighten screws to 18 foot-pounds.

4. Damaged governor gasket.

5. Solenoid connector terminal O-ring damaged.

6. Parking pawl shaft O-ring damaged.

7. Manual shaft cup plug damaged.

8. Vacuum modulator damaged.

9. Vacuum modulator retainer screw loose. Tighten to 18 foot-pounds.

10. Vacuum modulator diaphragm damaged. Disconnect vacuum line on vacuum modulator if red transmission fluid appears on vacuum side modulator is defective.

NOTE: If transmission is found to be consistently low on oil, check vacuum modulator to make certain diaphragm has not ruptured. Apply suction to vacuum tube and check for leaks. A ruptured diaphragm would allow transmission oil to be drawn into intake manifold and vacuum line. Usually the exhaust will be excessively smoky due to transmission oil added to the combustion.

11. Bottom pan gasket damaged.

12. Bottom pan attaching screws loose. Tighten to 12 foot-pounds.

13. Line pressure plug not tight. Tighten to 10 foot-pounds.

14. Porous or cracked casting.

15. Vent pipe.

a. Transmission over-filled.

b. Water in oil.

c. Pump to case gasket mispositioned.

d. Foreign material between pump and case, or between pump cover and body.

e. Case - Porous, pump face improperly machined.

f. Pump - Shy of stock, porous.

d. Oil Cooler Pipe Connections

1. Outside oil cooler pipe connections improperly installed or damaged. Also connectors in radiator and transmission.

2. Oil cooler pipe connections not tight. Tighten to 28 foot-pounds at transmission and 40 foot-pounds at radiator.

3. Flare on oil cooler pipes damaged at radiator or transmission.

e. Filler Pipe

1. O-ring damaged or improperly installed on pipe.

2. Filler pipe not fully seated in case.

f. Internal Leaks

It will be necessary to remove bottom pan to determine location of internal leaks.

1. Governor pipes damaged.

2. Rear servo cover attaching screws not tight. Tighten to 18 foot-pounds.

3. Rear servo cover gasket damaged.

4. Control valve assembly-to-spacer or case gaskets damaged.

5. Control valve assembly attaching screws loose. Tighten to 8 foot-pounds.

6. Solenoid gaskets damaged.

7. Solenoid attaching screws loose. Tighten to 8 foot-pounds.

8. Intake pipe O-ring damaged.

9. Rear servo square cut O-ring improperly installed or damaged.

4. Manual Linkage Adjustments (Fig. 7-22)

1. Loosen nut on steering column manual lever to relay rod clamp.

2. Pull relay rod up to position transmission shift valve in Park, then push rod down to the third (Neutral) step. Make sure rod is centered in this detent position.

3. Position selector lever in Neutral, against quadrant stop in steering column.

4. Tighten steering column manual lever to relay rod clamp nut, making sure shift lever is

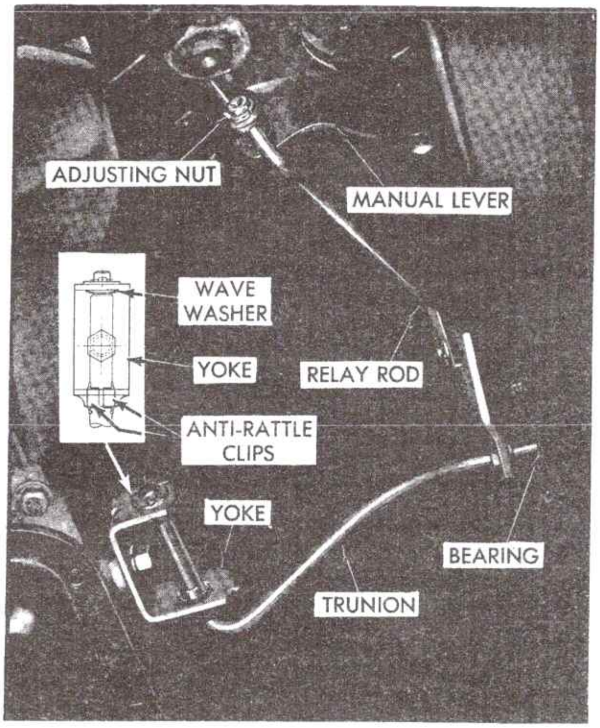


Fig. 7-22 Adjusting Manual Linkage

held against Neutral stop while this operation is being performed.

5. Check operation of selector lever by performing the following steps:

a. Lift lever and move to Neutral detent. (This is the detent in the transmission.) Release the lever and check to make sure that the lever is not riding up on top of the Neutral stop nor has excessive clearance to it.

b. Move lever to Drive detent. There should be a slight travel of the lever beyond this detent until the drive stop in the steering column is reached.

c. Move lever to Reverse detent and check as in b above.

NOTE: Whenever linkage is readjusted, check for proper operation of neutral safety switch.

5. Transmission Downshift Switch Adjustment

1. Remove carburetor air cleaner.

2. Make certain that carburetor is adjusted to specification and that throttle linkage is at low speed idle setting.

3. If transmission downshift switch is properly adjusted, a #31 (wire gage size) drill or equivalent can be inserted through the calibrating hole below lower wire terminal extending through to carburetor side of switch.

4. If adjustment is necessary, loosen the two 7/16" switch mounting screws and position switch for proper alignment to perform step 3.

5. With switch positioned, tighten mounting screws and remove #31 drill from calibrating hole through switch.

6. Install air cleaner.

6. Stator and Downshift Solenoids Circuit Check

NOTE: Before checking the stator and downshift solenoids circuitry, make certain that the transmission downshift switch is properly adjusted as described in Note 5.

a. Preliminary Check

1. With transmission shift lever in Park, turn ignition switch to "ON" position, but do not start car.

2. Working under hood, slowly advance throttle linkage to wide open position, three clicks should be heard from transmission.

NOTE: On 697 and 698 series cars, only one click will not be heard as these cars do not use the stator solenoid.

3. Allow throttle to return to closed position, three clicks should be heard from transmission, except on 697 and 698 series cars where one click should be heard.

4. Interpreting results of preliminary check:

a. If system performed as described in steps 2 and 3, solenoid circuits are operating properly.

b. If no click was heard in step 3 on 697 and 698 series cars, proceed to step 5.

c. If one click was heard in step 2 and one click was heard in step 3, on all cars except 697 and 698 series cars, proceed to steps listed under procedure c.

d. If two clicks were heard in step 2 and two clicks were heard in step 3, on all cars except 697 and 698 series cars, proceed to steps listed under procedure b.

e. If no clicks were heard in steps 2 or 3, proceed to step 5.

5. Check 10 amp Trans-Inst. fuse in fuse block.

a. If fuse is defective, replace fuse and recheck system.

b. If fuse is operative, proceed to step 6.

6. Remove air cleaner and, using a test light, check black striped orange feed wire at transmission downshift switch.

a. If test light fails to light, feed wire is open between downshift switch and fuse block. Locate source of malfunction, repair and recheck system.

b. If test light lighted, proceed to step 7.

NOTE: On 697 and 698 series cars, the white wire, referred to in the following steps, is not used.

7. With throttle in wide open position, use test light to check orange and white wires at transmission downshift switch.

a. If test light fails to light, transmission downshift switch is defective, replace and recheck system.

b. If test light lighted, proceed to step 8.

8. With throttle in wide open position, use test light to check orange and white wires at connector on side of transmission case.

a. If test light fails to light, wire or wires between downshift switch and connector are open. Locate source of malfunction, repair and recheck system.

b. If test light lighted, failure is within transmission. Replace solenoids, after first checking to see that internal wiring is operational.

b. Downshift Solenoid Circuit Check

1. With throttle in wide open position, use test light to check orange wire at connector on side of transmission case.

a. If light lights, failure is within transmission. Replace downshift solenoid, after first checking to see that internal wiring is operational.

b. If test light fails to light, proceed to step 2.

2. Remove air cleaner and with throttle in wide open position, use test light to check orange wire at transmission downshift switch.

a. If light lights, orange wire is open between downshift switch and transmission case connector. Locate malfunction, repair and recheck system.

b. If test light fails to light, transmission downshift switch is defective. Replace switch and recheck system.

c. Stator Solenoid Circuit Check

1. With throttle in wide open position, use test light to check white wire at connector on side of transmission case. Repeat check with throttle in closed position.

a. If light lights in both checks, failure is within transmission. Replace stator solenoid, after first checking to see that internal wiring is operational.

b. If light lights in only one check and not in the other, replace transmission downshift switch and recheck system.

c. If light fails to light in both checks, proceed to step 2.

2. Remove air cleaner and with throttle in wide open position, use test light to check white wire at transmission downshift switch. Repeat check with throttle in closed position.

a. If light lights in both checks, white wire is open between downshift switch and transmission case connector. Locate malfunction, repair and recheck system.

b. If light fails to light in both checks, replace transmission downshift switch and recheck system.

7. Checking and Adding Fluid

CAUTION: Car level and oil temperature are particularly important when checking fluid level on a Turbo Hydra-matic transmission. Careful attention to the following procedures is necessary in order to determine the actual fluid level.

a. Turbo Hydra-Matic Oil Recommendations

Whenever fluid is added, use only Type "A" Transmission Fluid, designated AQ-ATF, followed by three or four numerals and the suffix letter "A". Only a fluid bearing the suffix letter "A" in its designation should be used, as this indicates a superior grade of transmission fluid.

The transmission dipstick and filler tube on 1967 Cadillacs is located under the hood at the right rear side of the engine.

The bottom pan should be drained every 24,000 miles or 2 years, whichever occurs first, and

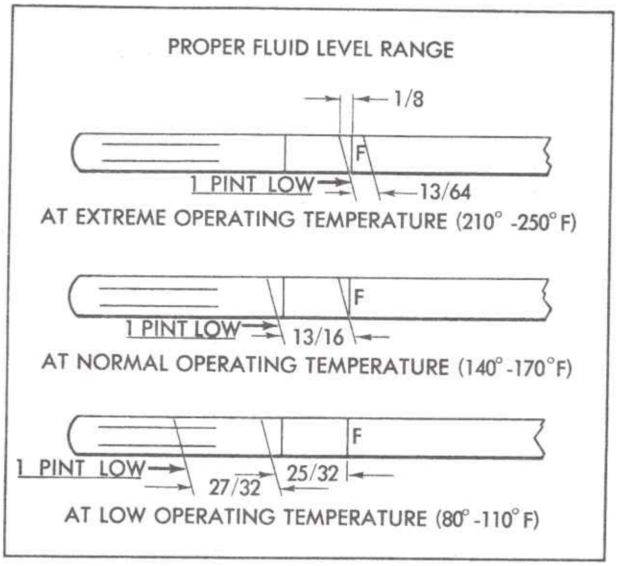


Fig. 7-23 Transmission Oil Level (Except 693)

fresh fluid added to obtain the proper level on the dipstick, Fig. 7-23. For cars subjected to heavy city traffic during hot weather, or in commercial use, when the engine is regularly idled for prolonged periods, the bottom pan should be drained every 12,000 miles.

The oil intake system incorporates an intake pipe and strainer assembly that should be replaced after the first 24,000 miles or 2 years, whichever occurs first.

In any case of a major transmission failure, the strainer assembly must be replaced, as well as the converter assembly. In addition, the oil cooler and lines should be flushed.

b. Checking and Adding Fluid

Fluid level should be checked at every engine oil change. The full "F" and "ADD" dimple marks on the transmission dipstick indicate one pint difference. Correct fluid level is determined at normal operating temperature (170°F.). Careful attention to transmission oil temperature is necessary, as proper fluid level at low operating temperatures will be below the "ADD" mark on the dipstick, Fig. 7-23, and proper fluid level at higher operating temperatures will rise above the full "F" mark. Fluid level must always be checked with car on level surface, and with engine running to make certain converter is full. To determine proper fluid level, proceed as follows:

1. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

2. Reduce engine speed to slow idle and check fluid level.

3. With engine running, add fluid, if necessary, to bring to proper level, Fig. 7-23.

CAUTION: Do not overfill, as foaming might occur when fluid heats up. If fluid level is too low, especially when cold, complete loss of drive may result after quick stops. Extremely low fluid levels will result in damage to the transmission.

c. Draining Bottom Pan and Replacing Intake Pipe and Strainer Assembly

To drain bottom pan only, eliminate steps 4 and 5.

1. Raise car on hoist or place on jack stands, and provide container to collect draining oil.

2. Remove bottom pan and gasket. Discard gasket.

3. Drain fluid from bottom pan. Clean pan with solvent and dry thoroughly with clean compressed air.

4. Remove intake pipe and strainer assembly. Remove and discard intake pipe O-ring.

5. Install new intake pipe O-ring into pipe bore in transmission case and install new intake pipe and strainer assembly.

6. Install new gasket on bottom pan and install bottom pan. Tighten bottom pan attaching screws to 12 foot-pounds.

7. Lower car and add 3 quarts of transmission fluid through filler tube when replacing intake pipe and strainer assembly. When draining bottom pan only add 2 quarts of transmission fluid.

8. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

9. Reduce engine speed to slow idle and check fluid level. Add fluid, if necessary, to bring to proper level, Fig. 7-23.

d. Adding fluid to Fill Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic transmission and converter assembly is approximately 11 quarts and 6 ounces, but correct level is determined by mark on dipstick rather than by amount added. It is important that proper level be maintained. In cases of transmission overhaul, when a complete fill is required, including converter, proceed as follows:

1. Add 7 quarts of transmission fluid through filler tube.

2. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

3. Reduce engine speed to slow idle.

4. Check fluid level and add additional fluid, if necessary, to bring to proper level, Fig. 7-23.

8. Towing Instructions

1967 Cadillac cars cannot be started by pushing, and this procedure should never be attemped. If the car cannot be started in the normal manner or by the use of jumper cables, it should be towed to the nearest authorized service facility.

If the transmission, drive line, or axle do not have a malfunction, the vehicle may be towed in Neutral "N" at speeds up to 35 mph for distances up to 50 miles. For higher speeds or extended distances, it is recommended that propeller shaft be disconnected or rear wheels be off ground. Before towing, check transmission fluid level. Fluid level must be above full mark on the dipstick with engine "OFF". Always tow car with transmission shift lever in Neutral position.

If tow requires raising front or rear of car, wheels should be lifted just slightly off the ground. When towing with rear wheels raised, tie down steering wheel with front wheels in straight ahead position.

9. Units that can be Removed with Transmission in Car

The following units can be removed from the transmission without removing transmission from car.

While the detailed procedure for removing each of the units, other than the extension housing and oil seal, and pressure regulator valve, is not outlined separately, the procedures covered under the transmission disassembly and assembly notes will apply.

a. Extension Housing

Removal - Note 11a

Installation - Note 11b

Oil Seal Replacement - Note 10

b. Pressure Regulator Valve

Removal - Note 12a

Installation - Note 12b

c. Vacuum Modulator and Valve

Removal - Note 16a

d. Governor Assembly

Removal - Note 16b

Disassembly - Note 17f

Installation - Note 18k

e. Speedometer Driven Gear Assembly

Removal - Note 16c

Disassembly - Note 17g

Installation - Note 18l

f. Intake Pipe and Strainer Assembly and Bottom Pan

Removal - Note 16d

Installation - Note 18m

g. Control Valve Assembly, Governor Pipes, and Detent Spring and Roller Assembly

Removal - Note 16e

Disassembly - Note 17h

Installation - Note 18i

h. Rear Servo Assembly

Removal - Note 16f

Disassembly - Note 17i

Installation - Note 18h

i. Detent Solenoid, Solenoid Connector, Control Valve Spacer and Gaskets, Check Balls, and Front Servo Assembly

Removal - Note 16h

Front Servo Disassembly - Note 17j

Installation - Note 18g

j. Detent Lever, Manual Shaft, and Parking Linkage

Removal - Note 16l

Installation - Note 18d

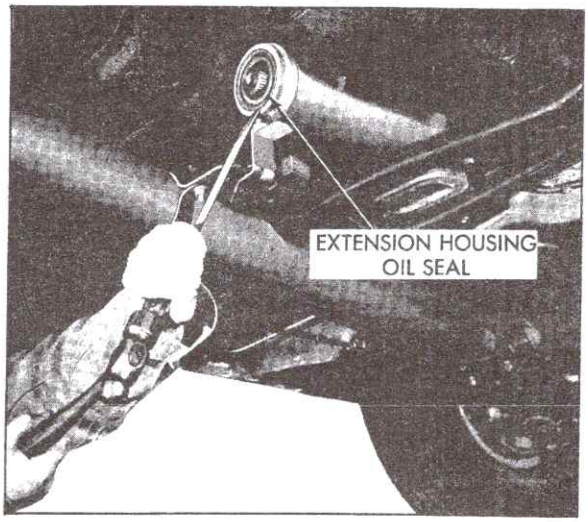


Fig. 7-24 Removing Extension Housing Oil Seal

10. Extension Housing Oil Seal Replacement (Transmission in Car)

1. Raise car on hoist or place on jack stands.

2. Remove propeller shaft assembly as described in Section 4, Note 28a or 29a.

NOTE: On 697 and 698 series cars, check propeller shaft front slip yoke for leak as described in Section 4, Note 30.

3. Use hammer to drive screwdriver under lip of oil seal and pry seal out of housing, Fig. 7-24.

4. Apply non-hardening sealer to outside of new seal and install seal in extension housing using Oil Seal Installer, J-21464, Fig. 7-25.

5. Install propeller shaft assembly as described in Section 4, Note 28b or 29b.

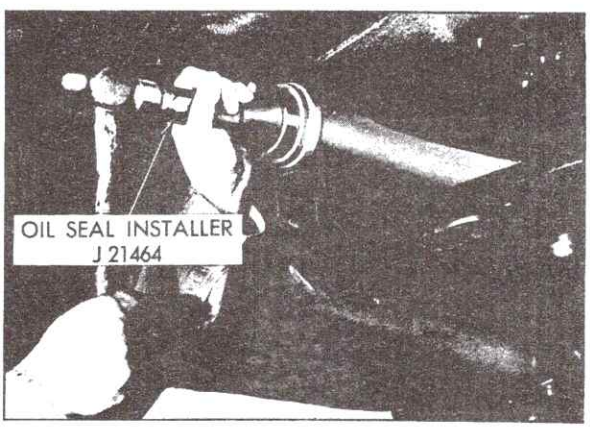


Fig. 7-25 Installing Extension Housing Oil Seal

6. Lower car.

11. Extension Housing Removal and Installation (Transmission in Car)

a. Removal

1. Raise car on hoist or place on jack stands.

2. Remove resonator support bracket from extension housing.

3. Remove propeller shaft assembly as described in Section 4, Note 28a or 29a.

4. Remove rear engine mount to extension housing attaching screws.

5. Place jack under bottom oil pan. Use a block of wood to prevent damage to pan and raise transmission to lift extension housing off rear engine mount.

6. Remove six extension housing attaching screws and slide extension housing rearward and downward to remove from car. Make certain that output shaft splines do not come in contact with extension housing oil seal, as splines could damage seal lip.

7. Remove and discard O-ring from output shaft.

b. Installation

1. Install gasket on extension housing.

2. Install new O-ring on output shaft.

3. Carefully install extension housing over output shaft and against transmission case. Do not permit output shaft to contact oil seal as splines could damage seal lip.

4. Install six extension housing to case attaching screws, tightening screws to 23 foot-pounds.

5. Lower transmission onto rear engine mount.

6. Install two rear engine mount to extension housing screws. Tighten screws to 55 foot-pounds.

7. Remove jack from bottom of oil pan.

8. Install propeller shaft assembly as described in Section 4, Note 28b or 29b.

9. Install resonator support bracket on extension housing. Tighten screw to 35 foot-pounds.

10. Lower car.

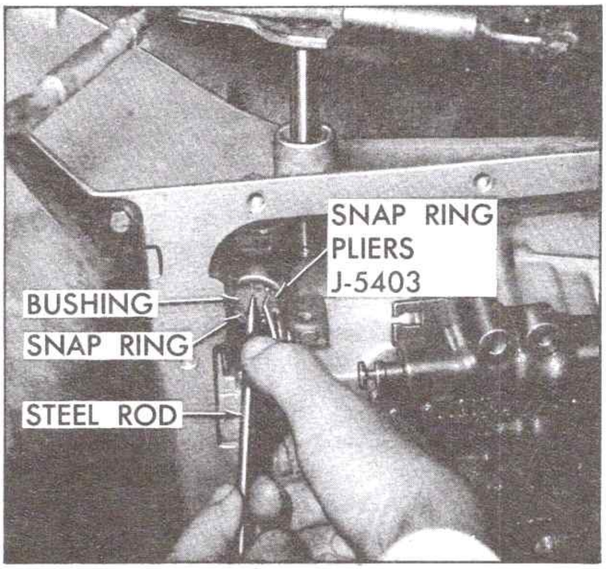


Fig. 7-26 Removing and Installing Pressure Regulator Valve

12. Pressure Regulator Valve Removal and Installation (Transmission in Car)

a. Removal

1. Raise car on hoist or place on jack stands. Provide container to catch oil.

2. Remove bottom pan and gasket. Drain oil.

3. Lift out pump intake pipe and strainer assembly.

4. Remove and discard intake pipe O-ring.

5. Using a screwdriver or steel rod, compress regulator boost valve bushing against pressure regulator spring, Fig. 7-26.

CAUTION: Pressure regulator spring is under extreme pressure and will force valve bushing out of bore when snap ring is removed if valve bushing is not held securely.

6. Continue to exert pressure on valve bushing and remove snap ring, using Snap Ring Pliers, J-5403 (#21). Gradually release pressure on valve bushing until all spring force is exhausted.

7. Carefully remove regulator boost valve bushing and valve, and pressure regulator spring. Be careful not to drop parts, as they will fall out if they are not held.

8. Remove pressure regulator valve and spring retainer. Remove spacers if present. Be careful not to drop pressure regulator valve when removing it from bore.

b. Installation

1. Install spring retainer on pressure regulator spring. Also install spacers if previously removed.

2. Install pressure regulator valve on spring, stem end first.

3. Install boost valve into bushing, stem end out, and stack parts so that pressure regulator spring is against valve bushing.

4. Install complete assembly into pressure regulator valve bore, being careful not to drop parts during installation.

5. Using a screwdriver or steel rod, compress regulator boost valve bushing against pressure regulator spring until it is beyond snap ring groove, and install snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-26.

NOTE: To facilitate installation of snap ring, encircle it around screwdriver or steel rod, compress tangs with snap ring pliers, and slide snap ring upward into ring groove in valve bore.

6. Install new intake pipe O-ring into pipe bore in transmission case and install intake pipe and strainer assembly.

7. Install new gasket on bottom pan and install bottom pan.

8. Install thirteen bottom pan attaching screws. Tighten screws to 12 foot-pounds.

9. Lower car to floor and add fluid to transmission as required.

13. Transmission Removal and Installation

a. Removal

1. Disconnect negative battery cable.

2. Raise car on hoist or place on jack stands.

3. Disconnect relay rod from trunnion lever and wire relay rod up out of the way to prevent damage while moving transmission.

4. Remove two screws and bearing assembly from frame side rail.

5. Disconnect trunnion from manual yoke on left side of transmission.

6. Remove speedometer drive cable and disconnect detent and stator wires.

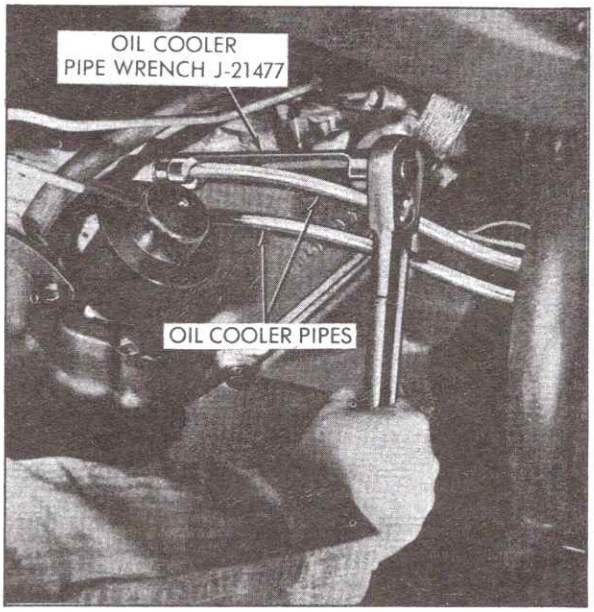


Fig. 7-27 Disconnecting Oil Cooler Pipes

7. Remove transmission filler tube bracket screw from right exhaust manifold.

8. Remove filler tube from transmission case and plug hole in case.

9. Disconnect oil cooler pipes at transmission using Oil Cooler Pipe Wrench, J-21477, Fig. 7-27. Cap pipes and plug connector holes in transmission. Position oil cooler pipes out of way.

10. Disconnect vacuum pipe hose from vacuum modulator and position vacuum pipe out of way.

11. Remove resonator support bracket from extension housing.

12. Remove propeller shaft as described in Section 4, Note 28a or 29a.

13. Remove two screws that hold starter motor to engine block. Remove starter motor bracket and slide starter forward.

14. Remove lower flywheel housing cover and two engine to transmission struts.

15. Remove three converter to flex plate attaching bolts.

NOTE: This is done by inserting a heavy screwdriver in open slot under one of the weld nuts on the converter, and rotating converter and flex plate until bolts can be reached for removal. Do not pry on flex plate ring gear to rotate converter, as flex plate might be damaged.

16. Place jack or other suitable device under rear of engine.

17. Position transmission jack under transmission and raise it just enough to take the load off rear engine support.

18. Remove two rear engine mount to extension housing screws.

19. Remove four bolts, two each side, from rear engine support and remove support.

20. Remove six transmission case to engine attaching screws. It may be necessary to lower engine and transmission slightly to gain access to upper attaching screws.

21. Move transmission toward rear of car, disengaging transmission case from locating dowels on engine, install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-28 and lower transmission from car.

CAUTION: Converter Holding Clamp must be used when removing transmission otherwise converter can fall out when transmission is removed.

22. Remove Converter Holding Clamp from transmission case and remove converter from turbine shaft.

CAUTION: Converter with oil weighs approximately fifty pounds. Be careful not to drop or damage converter when removing it.

b. Installation

1. Install converter on turbine shaft and install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-28.

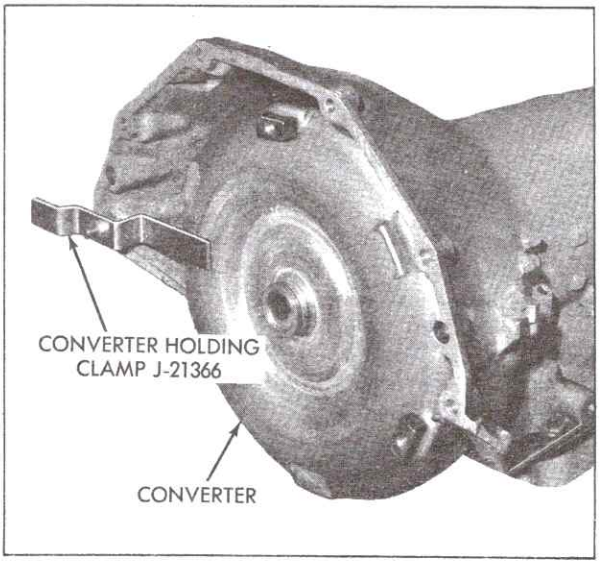


Fig. 7-28 Installing Converter Holding Clamp

2. Place transmission on transmission jack and carefully raise into position. Remove Converter Holding Clamp.

3. Align front of transmission case with engine and dowel holes in transmission case with dowels on engine. Install six transmission case to engine attaching screws, tighten screws to 30 foot-pounds.

CAUTION: The procedure for attaching the converter to the flex plate as described in steps 4 through 6 must be strictly followed. Any deviation from this procedure will result in improper installation and damage to flex plate and transmission.

4. Rotate converter until two of the three weld nuts on converter line up with two bolt holes in flex plate. Position converter so that weld nuts are flush with flex plate. Make certain converter is not cocked and that pilot in center of converter is properly seated in crankshaft.

5. Install two flex plate to converter attaching bolts through accessible bolt holes in flex plate and tighten to 28 foot-pounds.

Bolts must be tightened at this time to assure proper alignment of converter.

6. Insert screwdriver under converter weld nut, rotate converter and flex plate and install third attaching bolt. Tighten bolt to 28 foot-pounds. Do not pry on flex plate ring gear to rotate converter.

7. Install lower flywheel housing cover screws, tightening screws to 28 foot-pounds.

8. Install two engine to transmission struts, tightening screws to 23 foot-pounds.

9. Position starter motor to engine block and install two screws, tightening screws to 30 foot-pounds.

10. Install starter motor brackets, tightening screws to 23 foot-pounds.

11. Raise engine and transmission to about one inch above normal height and install rear engine support on frame. Install two bolts on each side, tighten bolts to 30 foot-pounds.

12. Lower transmission carefully and install two rear engine mount to extension housing screws. Tighten screws to 55 foot-pounds.

13. Remove jacks.

14. Install resonator support bracket to extension housing. Tighten screw to 35 foot-pounds.

15. Install speedometer cable and connect detent and stator wires to transmission.

16. Connect trunnion to manual yoke left side of transmission, placing small amount of Lubriplate in slotted leg of yoke.

17. Install trunnion bearing assembly to left frame rail.

18. Attach relay rod to trunnion lever.

19. Install vacuum hose on modulator.

20. Tighten brass cooler pipe connectors at case to 28 foot-pounds. Clean ends of oil cooler pipes with solvent and connect pipes to transmission using Oil Cooler Pipe Wrench, J-21477, Fig. 7-27. Tighten nuts to 28 foot-pounds.

21. Unplug oil filler tube hole in transmission case. Using a new O-ring on filler tube, install filler tube to case.

22. Install screw in filler tube bracket on right exhaust manifold. Tighten screw to 60 foot-pounds.

23. Install propeller shaft as described in Section 4, Note 28b or 29b.

24. Check operation of manual linkage. Adjust, if necessary, as described in Note 4.

25. Lower car and connect battery.

26. Add fluid to transmission as required.

14. Pump Oil Seal Replacement

1. Remove transmission assembly from car as described in Note 13a.

2. Use hammer to drive screwdriver or chisel under lip of oil seal and pry seal out of pump body, Fig. 7-29.

3. Before installing new seal, make certain bore is free from foreign material and that garter spring on seal is correctly positioned. Also check finish of converter neck and bearing surface in pump body.

NOTE: Use a non-hardening sealer on outside of seal body before installing seal.

4. Install new seal in pump body using Pump Oil Seal Installer, J-21359, Fig. 7-30.

5. Install transmission assembly in car as described in Note 13b.

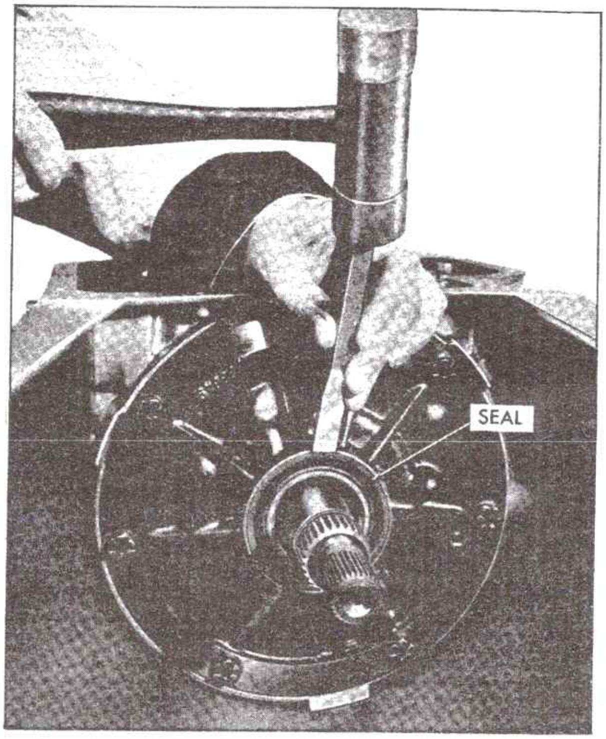


Fig. 7-29 Removing Pump Oil Seal

15. Converter

a. Leak Test

1. Remove transmission from car as described in Note 13a and remove converter from transmission.

2. Insert valve, part of Converter Leak Test Fixture, J-21369, in neck of converter and back-off large hex nut.

3. Install leak test fixture band crosswise on converter so that slotted plate fits around valve and under nut. Fig. 7-31. Tighten nut to expand O-ring and secure a good seal.

4. Apply compressed air with a service air

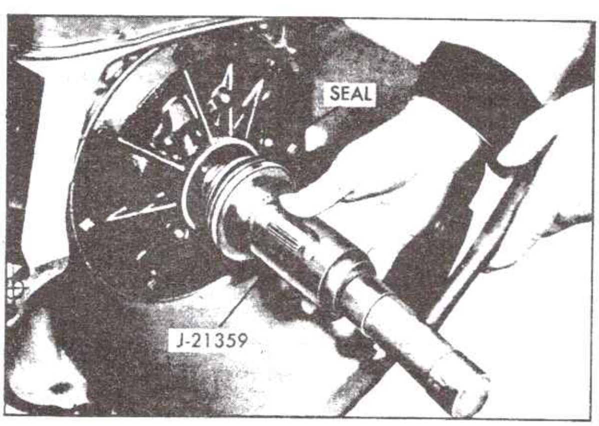


Fig. 7-30 Installing Pump Oil Seal

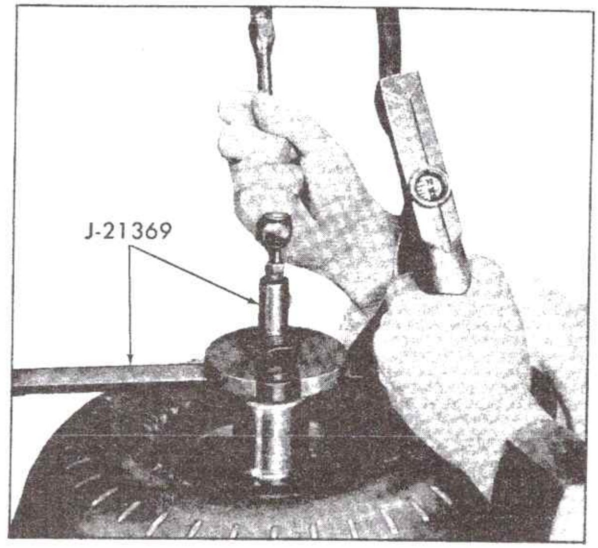


Fig. 7-31 Leak Checking Converter

hose until approximately 80 to 100 psi air pressure is obtained.

5. Immerse assembly in water, noting any sign of bubbles that would indicate a leak.

6. Depress valve stem to release air pressure in converter and then remove leak test fixture band and valve.

CAUTION: Always release air pressure before removing valve, as a definite hazard exists should valve blow out during removal.

7. Thoroughly dry converter and install converter in transmission as follows:

a. Place transmission in Holding Fixture, J-8763-01 and install Holding Fixture in Holding Fixture Base, J-3289-20, so that transmission is positioned vertically with pump end up.

b. Carefully position converter on turbine shaft,

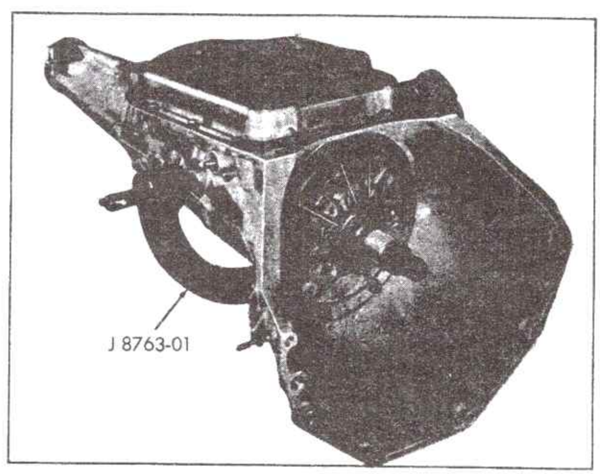


Fig. 7-32 Transmission in Holding Fixture

making certain converter is properly aligned. Long screws or eyebolts can be threaded into the weld nuts on the converter and used as handles.

c. Rotate converter until the shafts are piloted and the converter lugs are indexed in the pump gear.

d. If difficulty is experienced in alignment, tap on outer diameter of converter with plastic-headed hammer, while turning converter.

8. Install transmission on car.

b. Visual Inspection

1. Inspect converter for visual signs of damage.

2. Inspect for wrong converter.

3. Inspect bushing in neck of variable pitch converter for signs of wear.

4. Inspect neck of converter for wear.

5. Inspect pump drive slots for signs of wear.

16. Major Transmission Components—Removal (Fig. 7-1)

a. Remove Vacuum Modulator and Valve

NOTE: Unit may be removed without removing transmission or bottom pan.

1. Remove converter from transmission and install Holding Fixture, J-8763-01, on transmission so that vacuum modulator will be located on side of Holding Fixture nearest the bench. Install

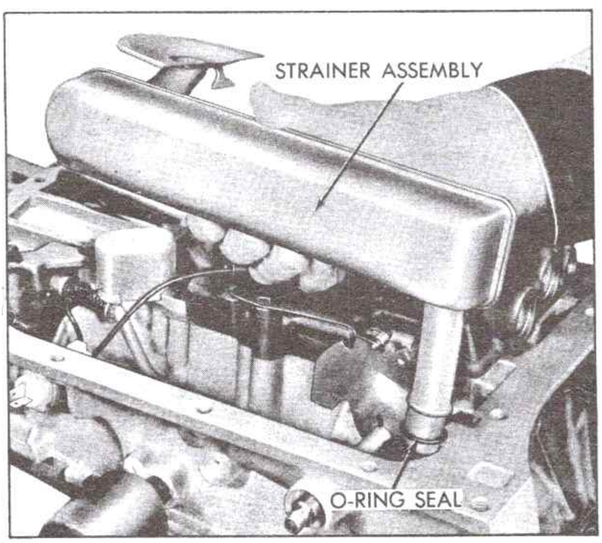


Fig. 7-33 Removing Intake Pipe and Strainer Assembly

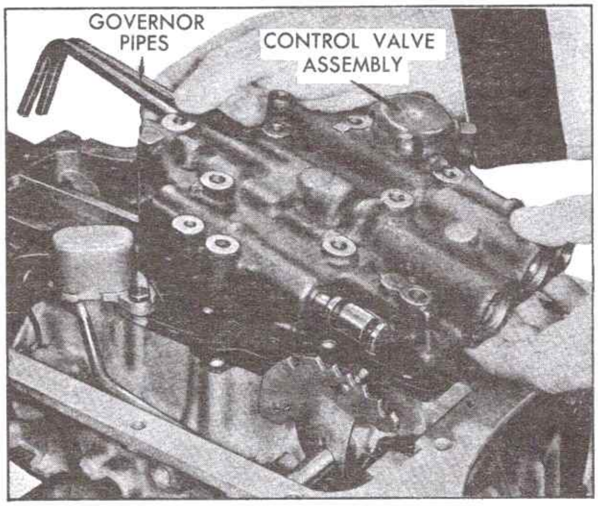


Fig. 7-34 Removing Control Valve Assembly

fixture and transmission into Holding Fixture Base, J-3289-20, with bottom pan facing up, Fig. 7-32, and install lock pin in base. Provide container to catch any oil that may drain from transmission.

2. Remove vacuum hose from modulator.

3. Remove vacuum modulator attaching screw and retainer from transmission case.

4. Remove modulator assembly and O-ring from case. Discard O-ring.

5. Remove modulator valve from transmission case.

b. Remove Governor Assembly

NOTE: Unit may be removed without removing transmission or bottom pan.

1. Remove four attaching screws, governor cover, and gasket. Discard gasket.

2. Remove governor assembly by pulling straight out of case.

c. Remove Speedometer Driven Gear Assembly

NOTE: Unit may be removed without removing transmission or bottom pan, after removing speedometer cable from driven gear assembly.

1. Remove attaching screw and retainer from left side of case. Apply slight pressure to remove sleeve and speedometer driven gear.

d. Remove Intake Pipe and Strainer Assembly and Bottom Pan

NOTE: Unit may be removed with trans-

mission in car. In cases of transmission failure, intake pipe and strainer must be replaced.

1. Remove bottom pan attaching screws.

2. Remove bottom pan and gasket. Discard gasket. Drain oil from pan if transmission is in car.

3. Lift out pump intake pipe and strainer assembly, Fig. 7-33.

4. Remove and discard intake pipe O-ring.

e. Remove Control Valve Assembly, Governor Pipes, and Detent Spring and Roller Assembly

NOTE: Units may be removed with transmission in car, after removing bottom pan and draining fluid.

1. Remove attaching screw and remove detent spring and roller assembly.

2. Remove twelve remaining control valve assembly attaching screws and clip, leaving clip attached to wire. Do not remove solenoid attaching screws at this time.

3. Remove control valve assembly with the two governor pipes attached, Fig. 7-34.

CAUTION: Do not allow manual valve to fall out of its bore in control valve assembly. Be careful not to drop front servo piston if it should come out with control valve assembly.

4. Remove governor pipes from valve body. Governor pipes are interchangeable and need not be identified.

5. Remove control valve assembly to spacer gasket.

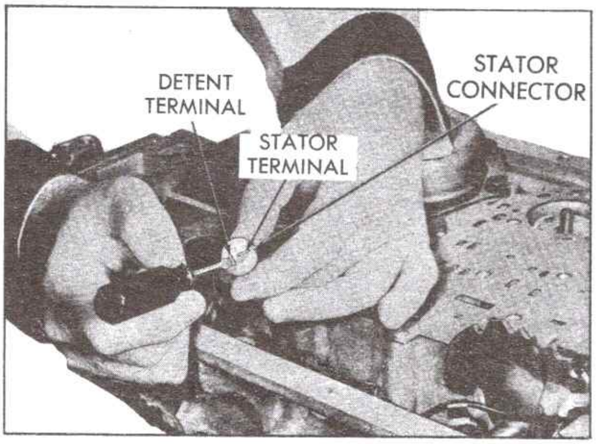


Fig. 7-35 Removing Detent Solenoid Wire

6. Remove stator connector from case connector and disconnect detent (short) wire from stator connector, Fig. 7-35.

f. Remove Rear Servo Assembly

NOTE: Unit may be removed with transmission in car after removing bottom pan and allowing fluid to drain. Remove control valve assembly, and governor pipes (Note 16e).

1. Remove six rear servo cover attaching screws, servo cover, and gasket. Discard gasket.

2. Remove rear servo assembly from transmission case, Fig. 7-36.

3. Remove servo accumulator spring.

4. Make band apply pin selection check to determine proper size pin to use at time rear servo is assembled. Proceed as follows:

g. Band Apply Pin Selection Check

NOTE: Check may be made with transmission in car. Remove bottom pan and allow fluid to drain. Remove control valve assembly, governor pipes (Note 16e) and rear servo (Note 16f).

1. Position Band Apply Pin Selector Gage, J-21370-6, on transmission case over rear servo bore, with hex nut on side of gage facing toward parking brake linkage, and smaller diameter end of Gage Pin, J-21370-5, in servo pin bore, Fig. 7-37.

2. Secure gage with two 5/16-18 x 1 inch screws, tightening screws to 18 foot-pounds. Make certain that stepped gage pin is free to move up

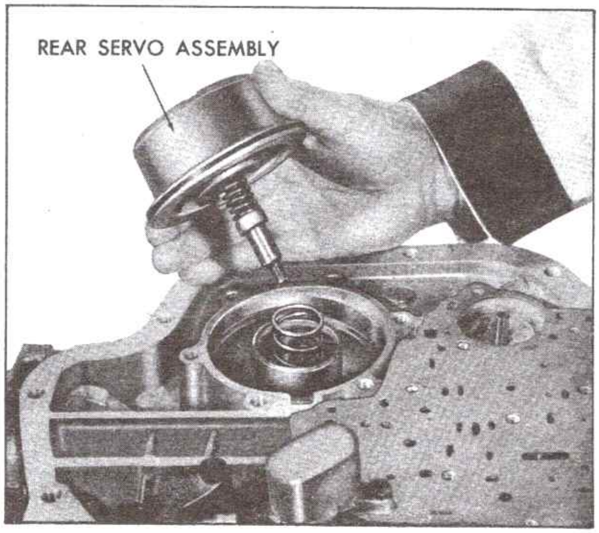


Fig. 7-36 Removing Rear Servo Assembly

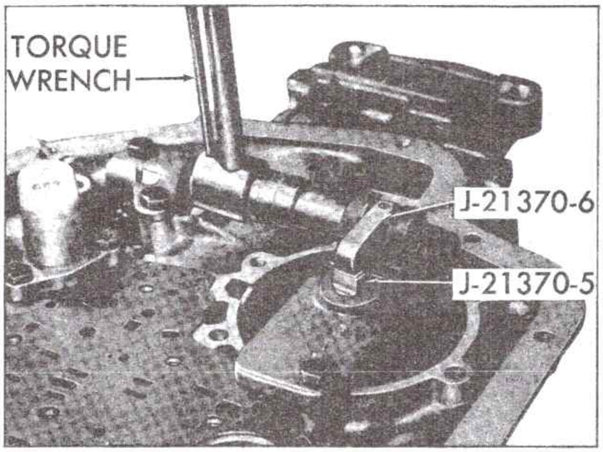


Fig. 7-37 Band Apply Pin Selection Check

and down in both tool and servo pin bore. Stepped side of pin must face front of transmission case.

Band apply pins are available in three sizes as shown in the following chart:

IDENTIFICATION	LENGTH
Three Rings	Long
Two Rings	Medium
One Ring	Short

Identification ring is located on band lug end of pin. Selecting the proper pin is equivalent to adjusting band.

3. To determine proper size pin to use, apply 25 foot-pounds torque on hex nut on side of gage, Fig. 7-37. This will cause lever on top of gage to depress stepped gage pin into servo pin bore, simulating actual operating conditions. Note relation of steps on gage pin and machined surface on top of gage. Determine proper size pin as follows:

a. If machined surface on top of gage is even with or above upper step on gage pin, long size pin (three rings) is required.

b. If machined surface on top of gage is between upper and lower steps on gage pin, medium size pin (two rings) is required.

c. If machined surface on top of gage is even with or below step on gage pin, short size pin (one ring) is required.

4. If new pin is required, make note of pin size required, and remove gage from transmission case.

h. Remove Detent Solenoid, Solenoid Connector, Control Valve Spacer, Gaskets, Check Balls, and Front Servo Assembly

NOTE: Units may be removed with transmission in car. Remove bottom pan and drain transmission fluid. To remove control valve spacer, gaskets, check balls, and front servo, remove control valve assembly and governor pipes (Note 16e).

1. Disconnect stator solenoid lead from connector terminal, Fig. 7-35, on AA transmissions.

2. Compress tabs on connector and remove connector and O-ring from case. Discard O-ring.

3. Remove two detent solenoid attaching screws and remove solenoid assembly and gasket.

4. Remove control valve spacer plate and gasket from case.

NOTE: If operation is being performed on car, lower control valve spacer plate in a level plane so that check balls don't fall out. Then remove check balls from spacer plate.

5. Remove six check balls from cored passages in transmission case.

6. Lift front servo piston, washer, pin, retainer and spring out of transmission case.

i. Remove Rear Oil Seal and Extension Housing

NOTE: Units may be removed with transmission in car. See Notes 10 and 11.

1. Use hammer to drive screwdriver under oil seal flange and pry seal out of extension housing.

2. Remove six extension housing attaching screws and remove extension housing.

3. Remove and discard gasket from extension housing.

j. Front Unit End Play Checking Procedure

NOTE: Transmission must be removed from car. (Note 13a)

1. Remove one oil pump attaching screw and either rubber-coated washer or O-ring at either 10 o'clock or 5 o'clock position.

NOTE: Seven of the eight pump attaching screws use a rubber-coated aluminum washer, while the eighth screw uses an O-ring for sealing purposes. The O-ring equipped screw does not have a particular location.

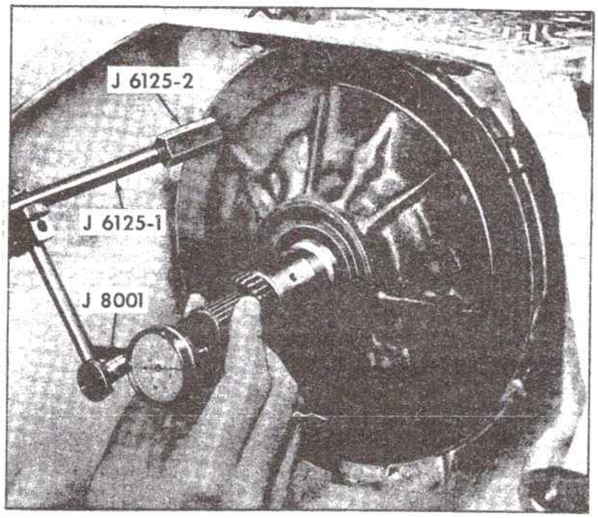


Fig. 7-38 Front Unit End Play Check

2. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, in screw hole where attaching screw was removed.

3. Mount Dial Indicator, J-8001, on slide hammer bolt and index indicator to register with flat surface on end of turbine shaft.

4. Hold output shaft forward while pushing turbine shaft rearward to its stop.

5. Set dial indicator to zero.

6. Pull turbine shaft forward, Fig. 7-38.

Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .003 inch - .024 inch. The selective washer controlling this end play is the phenolic resin washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the following chart.

THICKNESS	COLOR
.060 - .064	Yellow
.071 - .075	Blue
.082 - .086	Red
.093 - .097	Brown
.104 - .108	Green
.115 - .119	Black
.126 - .130	Purple

NOTE: An oil-soaked washer may tend to discolor. If necessary, measure washer for thickness.

7. Remove dial indicator. If oil pump is to be removed, do not remove slide hammer assembly at this time.

k. Remove Oil Pump

NOTE: For removing oil pump only, transmission must be removed from car (Note 13a).

1. If not done previously, perform the following steps:

a. Remove stator solenoid lead from solenoid connector and retainer clip, on AA transmissions.

b. Remove one oil pump attaching screw and either rubber-coated washer or O-ring at either 10 o'clock or 5 o'clock position.

NOTE: Seven of the eight attaching screws use a rubber-coated aluminum washer, while the eighth screw uses an O-ring for sealing purposes. The O-ring equipped screw does not have a particular location.

c. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, in screw hole where attaching screw was removed.

2. Remove other seven pump attaching screws and washers and O-ring if present.

3. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, into other threaded hole at 10 o'clock or 5 o'clock position in pump body and drive outward with slide hammers to remove pump assembly from transmission case, Fig. 7-39.

CAUTION: Drive outward in unison on both slide hammer assemblies to prevent cocking pump assembly in case.

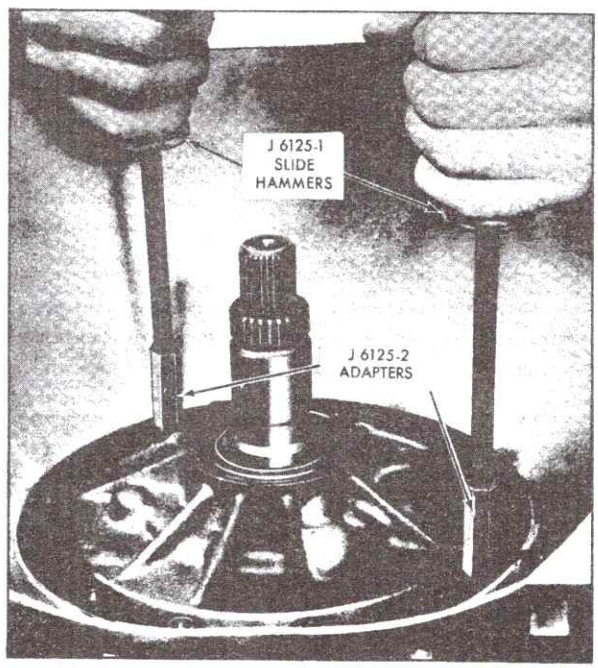


Fig. 7-39 Removing Pump Assembly

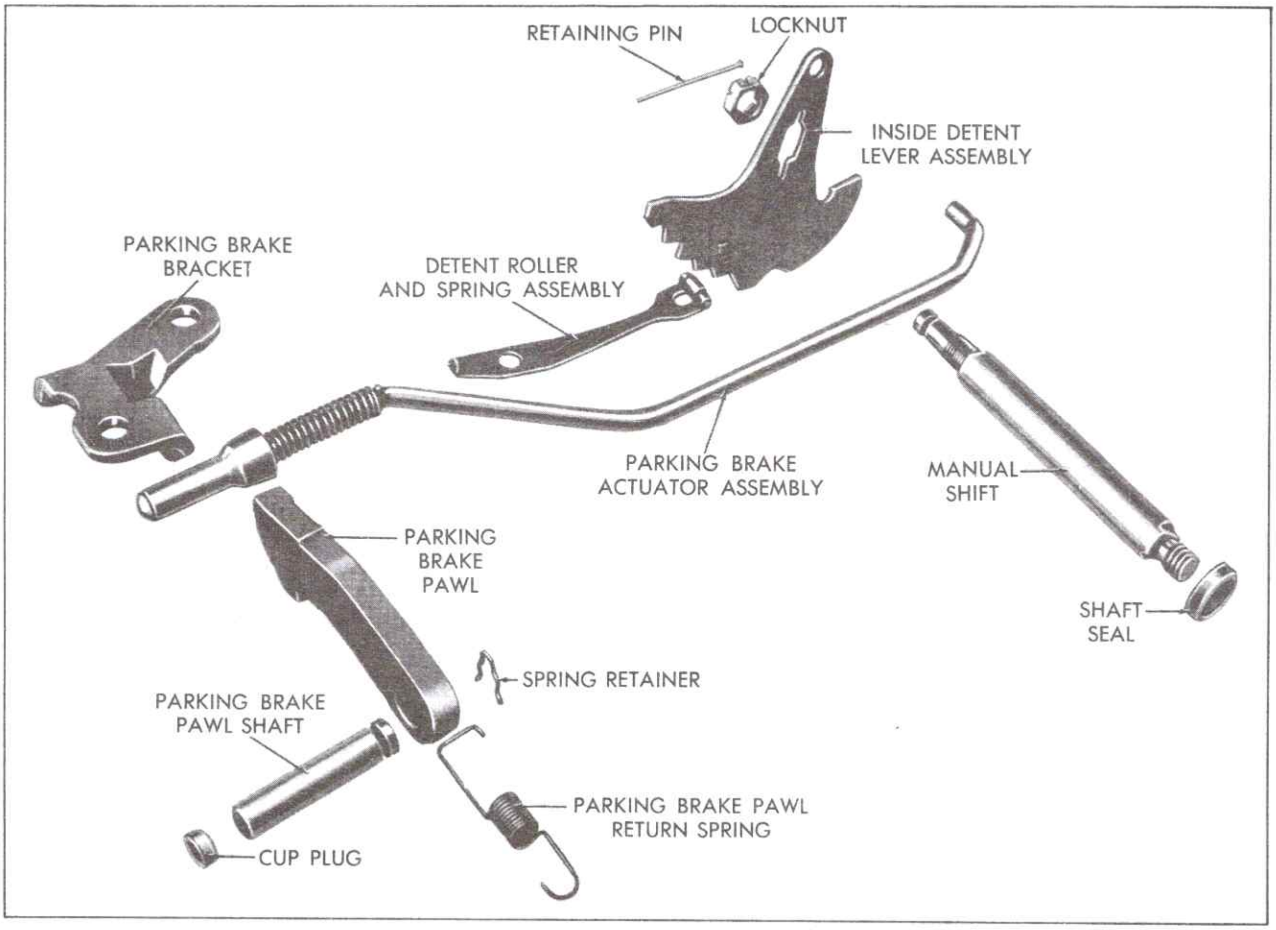


Fig. 7-40 Manual and Parking Linkage Disassembled

4. Remove slide hammer assemblies from pump.

5. Remove and discard pump square cut O-ring and gasket.

l. Remove Detent Lever, Manual Shaft, and Parking Linkage (Fig. 7-40)

NOTE: Units may be removed with transmission in car. Drain transmission fluid by removing bottom pan. Remove manual linkage from manual lever and remove detent spring and roller assembly from control valve assembly.

1. Remove pin securing manual shaft to case.

NOTE: If procedure is being performed on car, bend pin to remove it.

2. Loosen locknut securing inside detent lever to manual shaft.

3. Pry or work inside detent lever loose from manual shaft and remove locknut.

4. Remove manual shaft, parking actuator rod and detent lever from case.

NOTE: Do not remove manual shaft seal unless replacement is required.

5. Remove parking brake bracket attaching screws and remove bracket.

6. Remove parking pawl return spring.

NOTE: The following steps are to be completed only if one or more of the parts involved require replacement.

7. Remove spring retainer from parking pawl shaft.

8. Remove parking brake pawl shaft cup plug by placing screwdriver between parking pawl shaft and case rib and prying outward, Fig. 7-41.

9. Remove parking pawl shaft and parking pawl.

m. Remove Turbine Shaft and Forward Clutch Assembly, Direct Clutch Assembly, Sun Gear Shaft, and Front Band

NOTE: Transmission must be removed from car (Note 13a). Requires removal of oil pump (Note 16k).

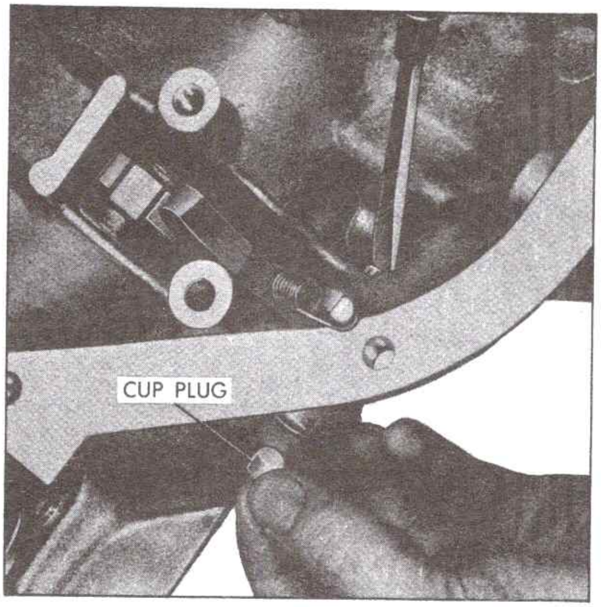


Fig. 7-41 Removing Cup Plug

1. Remove turbine shaft and forward clutch assembly from transmission, Fig. 7-42.

2. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch assembly.

3. Remove direct clutch and intermediate sprag assembly, Fig. 7-43. Sun gear shaft may come out with direct clutch assembly.

4. Remove sun gear shaft if not previously removed.

5. Remove front band assembly.

NOTE: Check rear unit end play at this time. Proceed as follows:

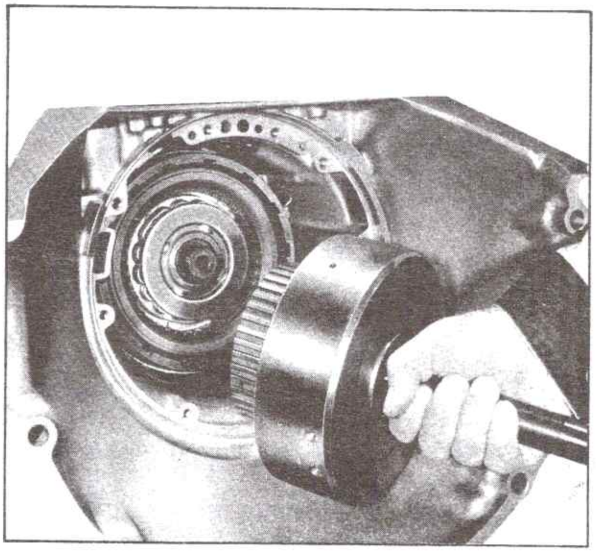


Fig. 7-42 Removing Forward Clutch Assembly

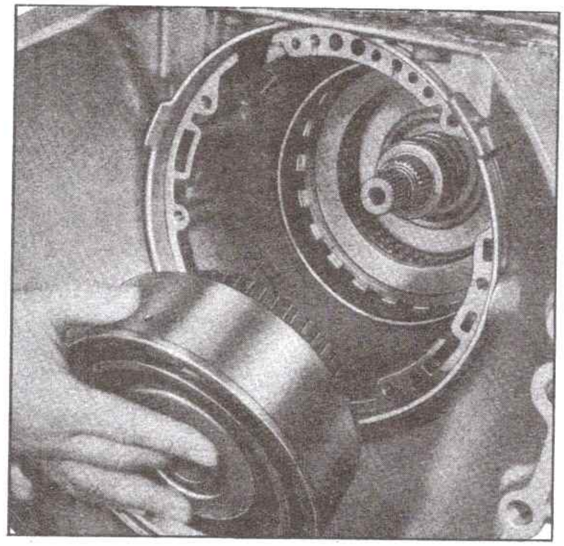


Fig. 7-43 Removing Direct Clutch and Intermediate Sprag Assembly

n. Rear Unit End Play Checking Procedure

NOTE: Transmission must be removed from car (Note 13a). Requires removal of extension housing.

1. Install Speedometer Puller Bolt, J-21797, in one of the bolt holes on end of transmission case.

2. Mount Dial Indicator, J-8001, on Bolt, J-21797, and index indicator to register with flat surface on end of output shaft, Fig. 7-44.

3. Set dial indicator to zero.

4. Move output shaft in and out. Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .003 inch - .019 inch.

The selective washer controlling this end play is the steel washer with the three tabs, located between thrust washer and rear face of transmission case. Notches on the tabs serve to identify washer thickness.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart.

THICKNESS	IDENTIFICATION NOTCH
.078 - .082	None
.086 - .090	On Side of 1 Tab
.094 - .098	On Side of 2 Tabs
.102 - .106	On End of 1 Tab
.110 - .114	On End of 2 Tabs
.118 - .122	On End of 3 Tabs

o. Remove Remaining Components

NOTE: Transmission must be removed from car (Note 13a). Requires removal of bottom pan, control valve assembly and governor pipes (Note 16e) rear servo assembly (Note 16f), control valve spacer, gaskets, check balls and front servo assembly (Note 16h), oil pump (Note 16k), turbine shaft, forward clutch housing, direct clutch assembly, sun gear shaft and front band (Note 16m).

1. Remove center support bolt from transmission case.

2. Remove intermediate clutch backing plate to case snap ring.

3. Remove intermediate clutch backing plate, and three composition and three steel clutch plates.

4. Using needle-nose pliers, or screwdriver, remove center support to case snap ring.

5. Install Tool, J-21795, on end of main shaft so that tangs engage groove in shaft. Tighten screw on tool to secure tool on shaft and prevent movement of roller clutch during removal of gear unit assembly.

6. Install proper diameter length of pipe over output shaft to be used as a handle and to prevent spline damage to case bushing when removing gear unit, center support, and reaction carrier.

NOTE: Loosen transmission holding fixture pivot pin slightly, so that gear unit assembly does not bind when it is removed from case.

7. With transmission case in a horizontal position, shift complete assembly toward front of case to facilitate removal of assembly from case. Remove complete gear unit assembly from case.

CAUTION: Be careful not to drop or bump assembly in transmission case during removal. This could result in damage to output shaft bushing in case as well as to assembly itself.

8. Remove output shaft to case thrust washer from output shaft or case.

9. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place gear unit assembly in holding fixture with main shaft pointing upward, Fig. 7-45. Remove Tool J-21795.

10. Remove center support assembly from reaction carrier by lifting straight upward.

11. Remove center support to reaction carrier thrust washer, Fig. 7-46.

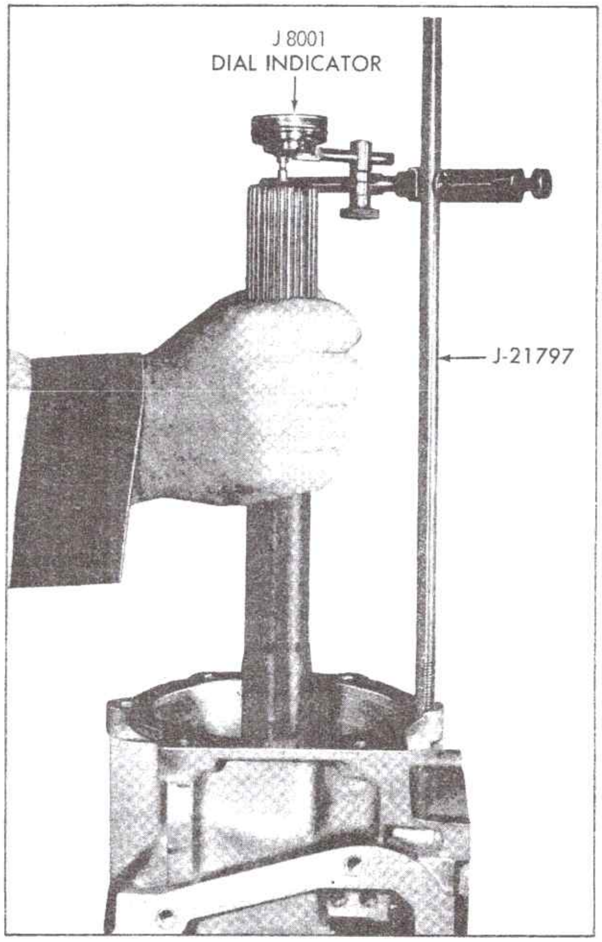


Fig. 7-44 Checking Rear Unit End Play

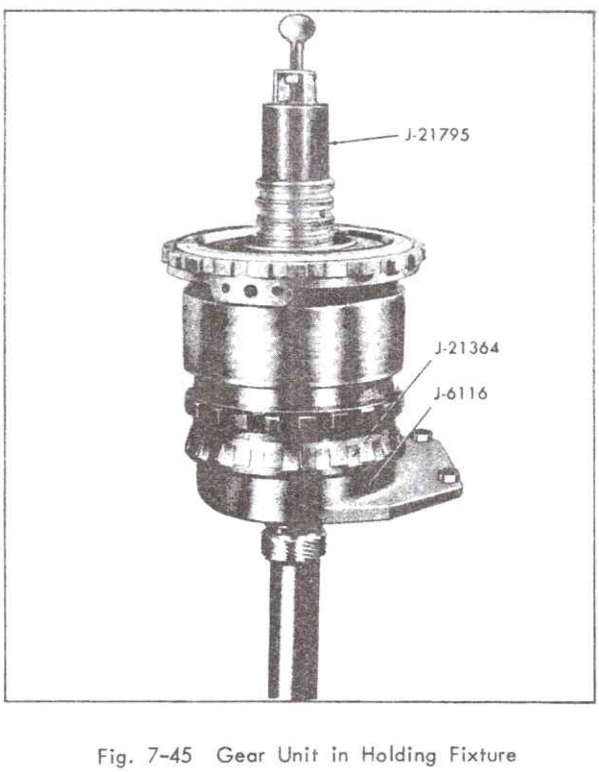


Fig. 7-45 Gear Unit in Holding Fixture

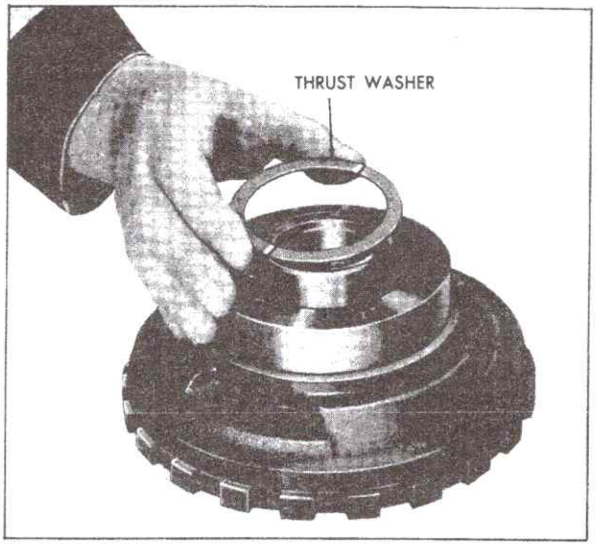


Fig. 7-46 Removing Center Support to Reaction Carrier Thrust Washer

NOTE: Thrust washer may have stuck to back of center support. If so, remove from center support.

12. Remove reaction carrier and roller clutch assembly from output carrier, Fig. 7-47, and remove roller clutch assembly from reaction carrier.

13. Remove rear unit selective washer from transmission case.

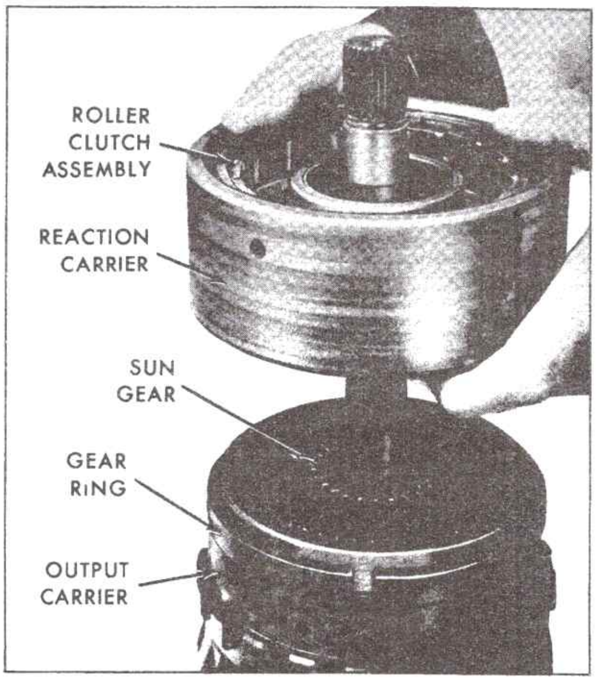


Fig. 7-47 Removing Reaction Carrier and Roller Clutch Assembly

14. Remove rear band assembly. To facilitate removal, rotate band lugs away from pins and pull band assembly out of transmission case.

17. Transmission Disassembly, Cleaning, Inspection and Assembly of Individual Units

Inspect each part thoroughly after the transmission and individual units have been disassembled and cleaned, to determine which parts should be replaced. It is very important to distinguish between parts that are simply "worn-in" and those parts worn to the extent that they affect operation of the unit. Only "worn-out", broken or damaged parts should be replaced.

a. Inspection of Torque Converter

1. Check converter for leaks as described in Note 15.

2. Check converter hub surfaces for signs of scoring or wear.

b. Inspection of Vacuum Modulator and Valve

1. Inspect vacuum modulator for any signs of bending or distortion.

2. Inspect O-ring seat for damage.

3. Apply suction to vacuum tube and check for leaks, the presence of red transmission oil in the vacuum section indicates a leak.

4. Inspect modulator valve for nicks or damage.

5. Check freeness of valve operation in case bore.

6. Check modulator for damaged bellows. Modulator plunger is under approximately 16 pounds pressure. If bellows is damaged, plunger will have very little pressure.

c. Inspection of Extension Housing

1. Inspect bushing for excessive wear or damage.

2. Inspect gasket mounting face for damage.

3. Inspect housing for cracks or porosity.

4. Be sure rear seal drain back port is not blocked.

d. Inspection of Detent Lever, Manual Shaft, and Parking Linkage

1. Inspect parking actuator rod for cracks, or broken spring retainer lugs.

2. Inspect actuator spring for damage.

3. Inspect actuator for a free fit on actuator rod.

4. Inspect parking pawl for cracks or wear.

5. Inspect manual shaft for damaged threads.

6. Inspect inside detent lever for cracks or a loose pin.

7. Inspect parking pawl return spring for deformed coils or ends.

8. Inspect parking bracket for cracks or wear.

9. Inspect detent spring and roller assembly.

e. Inspection of Transmission Case

1. Inspect case assembly for cracks, porosity or interconnected passages.

2. Check for good retention of band anchor pins.

3. Inspect all threaded holes for thread damage.

4. Inspect intermediate clutch driven plate lugs for damage or brinelling.

5. Inspect snap ring grooves for damage.

6. Inspect governor assembly bore for scratches or scoring.

7. Inspect modulator valve bore for scoring or damage.

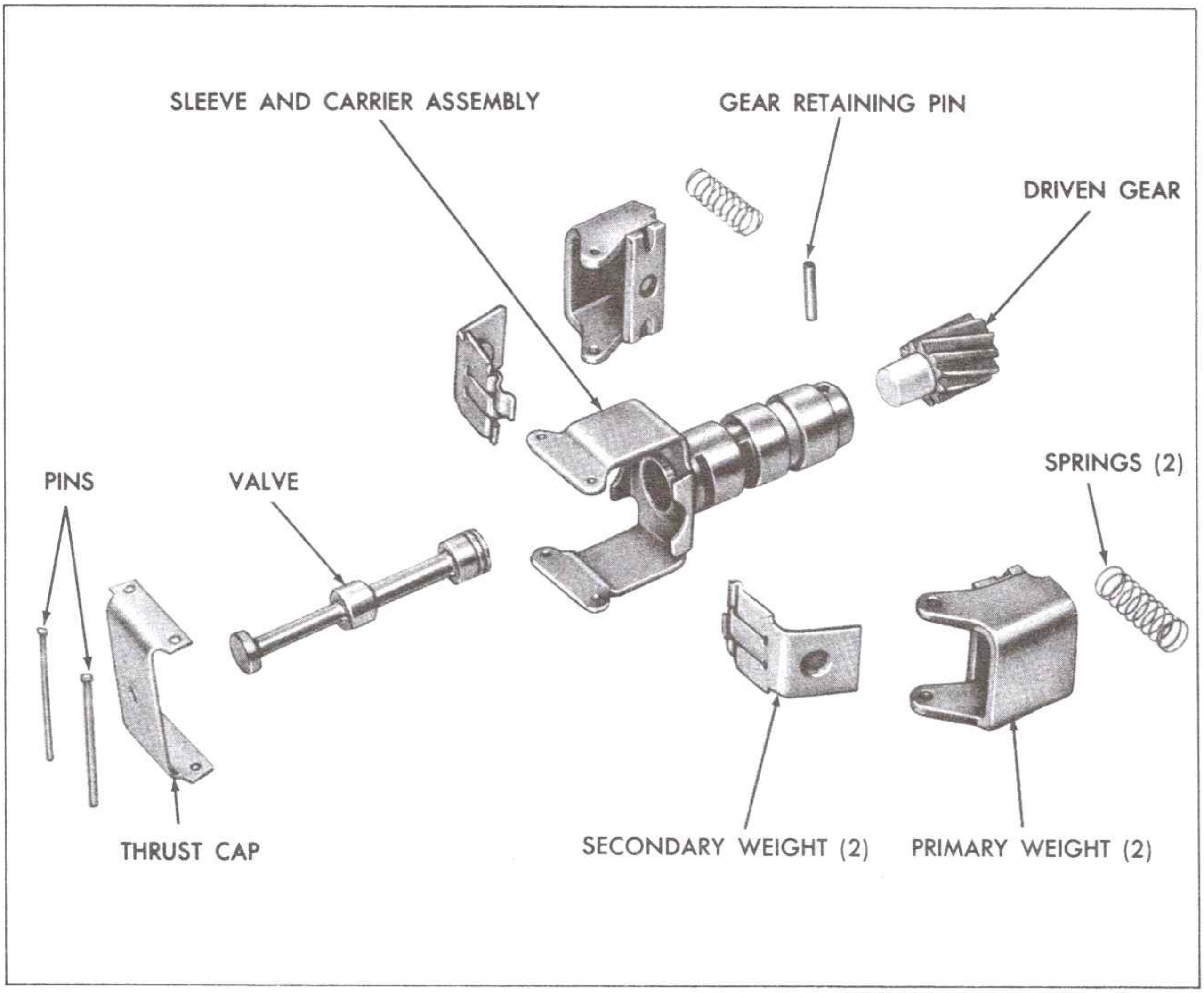


Fig. 7-48 Governor Assembly Disassembled

8.Inspect cup plug inside case for good staking and sealing.

f. Governor Assembly (Fig. 7-48)

All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.

It is necessary to disassemble the governor assembly in order to replace the driven gear. Disassembly may also be necessary due to foreign material causing improper operation. In such cases, proceed as follows:

Disassembly

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights, and springs. Governor weights are interchangeable from side to side and need not be identified.

2. Remove governor valve from governor sleeve. Be careful not to damage valve.

3. Perform the following inspections and replace governor driven gear if necessary.

Inspection

1. Wash all parts in cleaning solvent, air dry and blow out all passages.

2. Inspect governor sleeve for nicks, burrs, scoring or galling.

3. Check governor sleeve for free operation in bore of transmission case.

4. Inspect governor valve for nicks, burrs, scoring or galling.

5. Check governor valve for free operation in bore of goveror sleeve.

6. Inspect governor driven gear for nicks, burrs, or damage.

7. Check governor driven gear for looseness on governor sleeve.

8. Inspect governor springs for distortion or damage.

9. Check governor weights for free operation in their retainers.

10. Check valve opening at entry and exhaust (.020 inch minimum).

Governor Driven Gear Replacement

To facilitate governor repair in the field, a governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

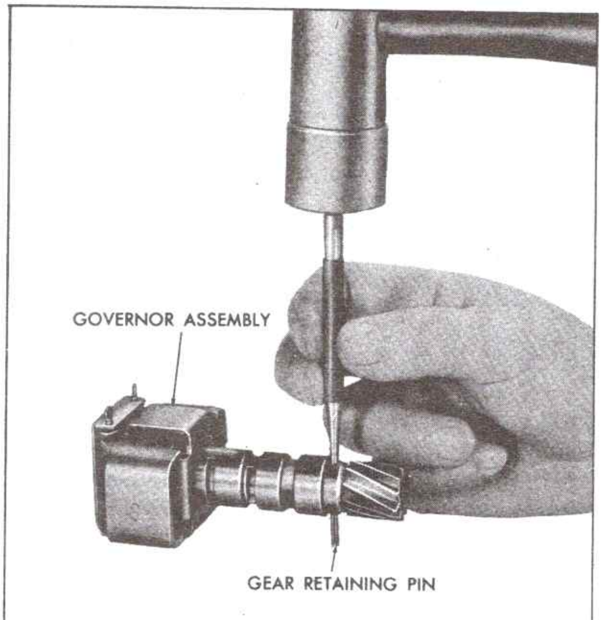
1. Drive out governor gear retaining split pin using small punch, Fig. 7-49.

2. Support governor on 3/16 inch plates installed in exhaust slots of governor sleeve, place in arbor press and, with a long punch, press gear out of sleeve.

3. Carefully clean governor sleeve of chips that remain from original gear installation.

4. Support governor on 3/16 inch plates installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.

5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90° from existing hole, center punch, and then while supporting governor in press, drill new hole through sleeve and gear using a 1/8 inch drill.



REMOVE—GOVERNOR GEAR RETANING PIN

Fig. 7-49 Removing Governor Driven Gear Retaining Pin

6. Install split retaining pin.

7. Wash governor assembly thoroughly to remove any chips that may have collected.

Assembly

1. Install governor valve in bore of governor sleeve.

2. Install governor weights and springs, and thrust cap on governor sleeve.

3. Align pin holes in thrust cap, governor weight assemblies, and governor sleeve, and install new pins. Crimp both ends of pins to prevent them from falling out.

4. Check governor weight assemblies for free operation on pins and valve for freeness in sleeve bore.

g. Speedometer Driven Gear Assembly

Disassembly

1. Remove speedometer driven gear from sleeve.

2. Remove O-ring from speedometer driven gear sleeve.

3. Remove C-wire ring retaining sleeve to gear lip seal.

4. Remove lip seal.

Inspection

1. Inspect gear for damaged teeth or shaft.

2. Inspect sleeve for scores, damaged threads or cracks.

3. Inspect seals for cuts or damage.

Assembly

1. Install sleeve to gear lip seal.

2. Install C-wire retaining ring.

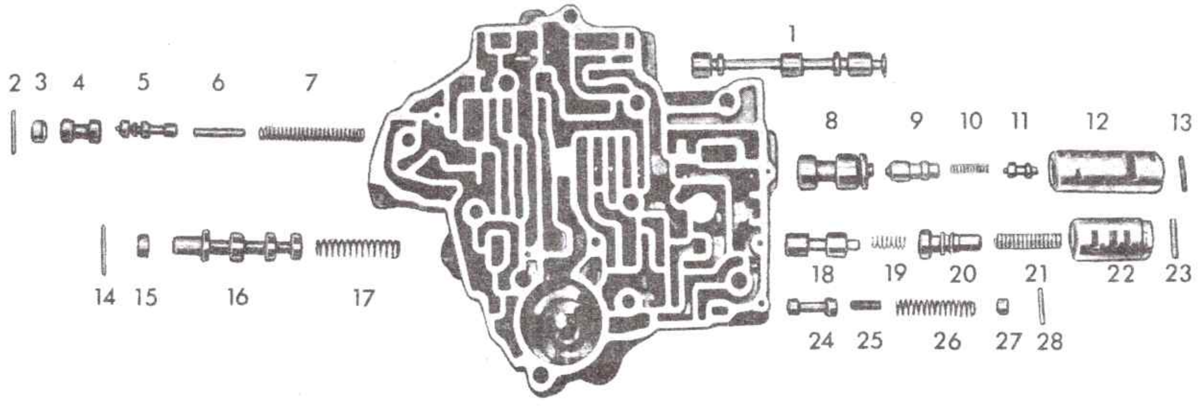
3. Install O-ring on speedometer driven gear sleeve.

4. Install gear in sleeve.

h. Control Valve Assembly (Fig. 7-50)

Disassembly

When disassembling control valve, make certain that springs are accurately identified so that they can be properly reassembled.



1. MANUAL VALVE
2. RETAINING PIN
3. BORE PLUG
4. DETENT VALVE
5. DETENT REGULATOR
6. SPACER
7. DETENT SPRING
8. 1-2 VALVE
9. 1-2 DETENT VALVE
10. 1-2 REGULATOR SPRING
11. 1-2 REGULATOR VALVE
12. 1-2 BUSHING
13. RETAINING PIN
14. RETAINING PIN
15. BORE PLUG
16. 1-2 ACCUMULATOR VALVE
17. 1-2 ACCUMULATOR SPRING
18. 2-3 VALVE
19. 3-2 INTERMEDIATE SPRING
20. 2-3 MODULATOR VALVE
21. 2-3 VALVE SPRING
22. 2-3 BUSHING
23. RETAINING PIN
24. 3-2 VALVE
25. SPACER
26. 3-2 SPRING
27. BORE PLUG
28. RETAINING PIN

Fig. 7-50 Control Valve Assembly Disassembled

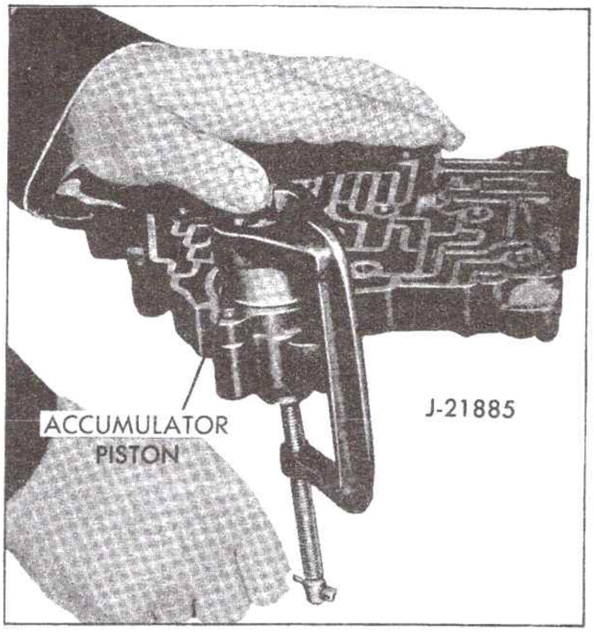


Fig. 7-51 Removing Front Accumulator Piston

1. Position control valve assembly with cored face up and accumulator pocket on bottom.

2. Remove manual valve from upper bore.

3. Install Control Valve Accumulator Piston Installer, J-21885, on accumulator piston, compress piston and remove E-ring retainer, Fig. 7-51.

4. Remove Installer, J-21885, and remove accumulator piston and spring.

5. Using pin punch, remove retaining pin from upper right bore, pressing on pin from outer side of valve body. Remove 1-2 modulator bushing, 1-2 regulator valve and spring, 1-2 detent valve and 1-2 shift valve from upper right bore.

NOTE: 1-2 regulator valve and spring may be inside of 1-2 modulator bushing.

6. Using pin punch, remove retaining pin from center right bore, pressing on pin from outer side of valve body. Remove 2-3 modulator bushing, 2-3 shift valve spring, 2-3 modulator valve, 3-2 intermediate spring and 2-3 shift valve from center right bore.

NOTE: 2-3 modulator valve will be inside of 2-3 modulator bushing.

7. Using pin punch, remove retaining pin from lower right bore, pressing on pin from outer side of valve body.

CAUTION: Hold hand over bore when removing retainer pin as 3-2 valve spring may force bore plug out.

8. Remove bore plug, 3-2 valve spring, spacer and 3-2 valve from lower right bore.

9. Using pin punch, remove retainer pin from upper left bore by pressing on outer side of valve body.

CAUTION: Hold hand over bore when removing retainer pin as detent regulator valve spring may force other components out of bore.

10. Remove bore plug, detent valve, detent regulator valve, spacer and detent regulator valve spring from upper left bore.

11. Remove grooved retaining pin from lower left bore by prying out with long nose pliers.

12. Remove bore plug, 1-2 accumulator valve and spring from lower left bore.

13. Remove governor oil feed screen assembly from governor oil feed hole in control valve body, Fig. 7-52.

Inspection

1. Wash control valve body, valves, and other parts in clean solvent.

CAUTION: Do not allow valves to bump together, as this might cause nicks and burrs.

2. Inspect all valves and bushings carefully to make sure that they are free from dirt and are not damaged in any respect. If burrs are present, they should be removed with a fine stone or fine grade of crocus cloth and light oil. Be careful not to round off shoulders of valves.

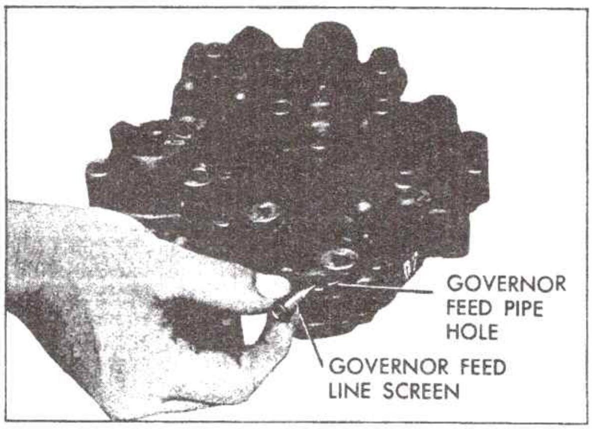


Fig. 7-52 Removing Governor Feed Line Screen

3. All valves and bushings should be tested in their individual bores to make certain that free movement can be obtained. All valves should fall freely of their own weight with a slight tapping action on the body. In checking, be careful to prevent valve damage in any way.

4. The manual valve is the only valve that can be serviced separately. If other valves are defective or damaged beyond repair, a new control valve assembly should be installed.

5. Inspect body for cracks or scored bores.

6. Check all springs for distortion or collapsed coils.

Assembly

1. Position front accumulator spring and piston into valve body.

2. Install Control Valve Accumulator Piston Installer, J-21885, on piston. Compress spring and piston, aligning spring and piston with bore.

CAUTION: Make certain that piston pin is correctly aligned with hole in piston and that oil seal ring does not catch on lip of bore when installing piston.

3. Secure piston and spring with E-ring retainer and remove Installer, J-21885.

4. Install 1-2 accumulator spring into lower left bore.

5. Install 1-2 accumulator valve, stem end out, into lower left bore.

6. Install 1-2 accumulator bore plug into lower left bore.

7. Place control valve body on cored side, compress plug and install grooved retaining pin from cast surface side of valve body, with grooved end of pin entering hole last.

8. Tap retaining pin with hammer until pin is flush with cast surface, and return control valve assembly to its original position.

9. Insert spacer inside of detent regulator valve spring and install spring and spacer into upper left bore, making certain spring seats in bottom of bore.

10. Compress detent regulator valve spring and hold with a small screwdriver placed between end of spring and wall on cored side of valve body.

11. Install detent regulator valve, stem end out,

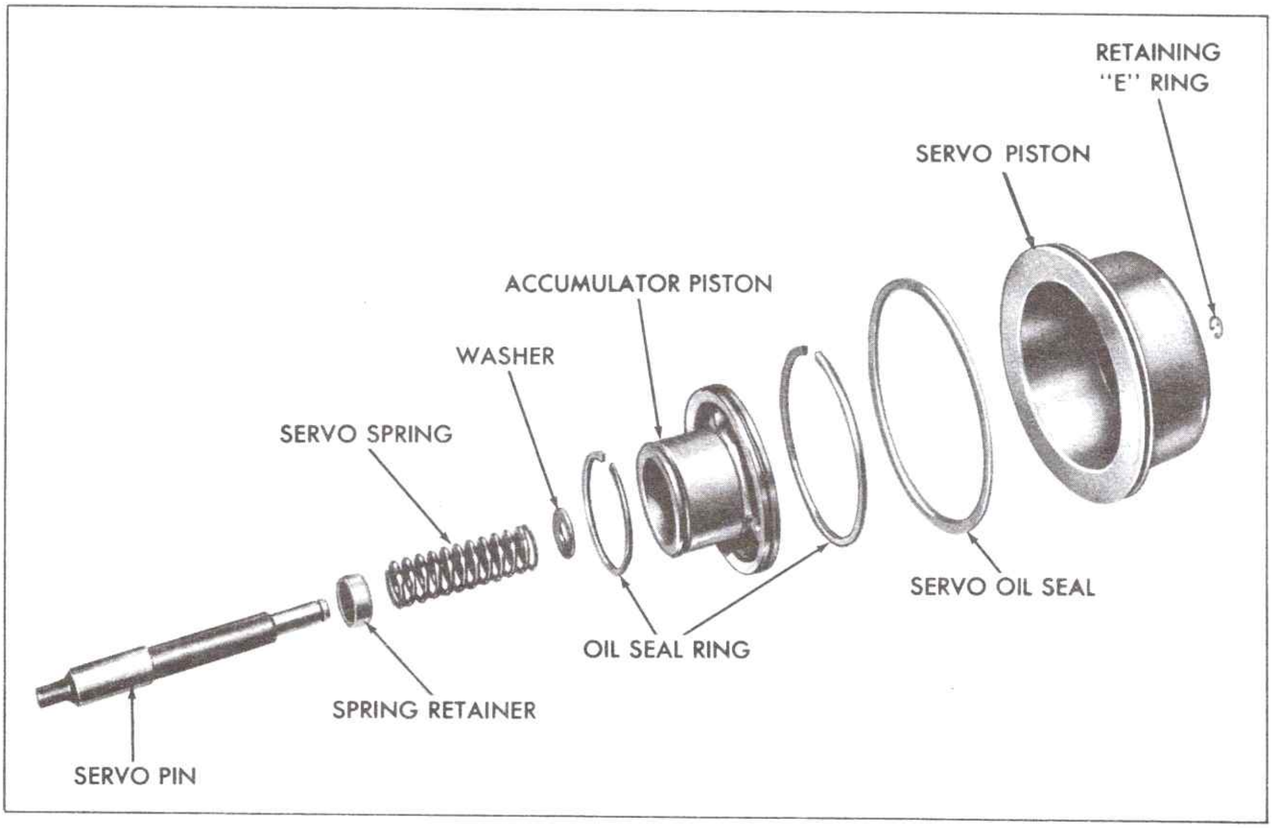


Fig. 7-53 Rear Servo and Accumulator Assembly Disassembled

and detent valve, small land first, into upper left bore.

12. Insert bore plug, hole out, into upper left bore and, pressing inward on bore plug, remove screwdriver and install retaining pin from cored side of valve body.

13. Install 3-2 valve in bottom right bore.

14. Insert spacer inside of 3-2 valve spring and install spring and spacer in bottom right bore.

15. Compressing 3-2 valve spring, install bore plug, hole end out, and secure with retaining pin from cored side of valve body.

16. Install 3-2 intermediate spring on stem end of 2-3 shift valve, and install valve and spring, valve first, into center right bore. Make certain valve seats in bottom of bore.

17. Install 2-3 modulator valve, hole end first, into 2-3 modulator bushing and install both parts in center right bore.

18. Install 2-3 shift valve spring into hole in 2-3 modulator valve, and compressing spring, secure with retaining pin from cored side of control valve.

19. Install 1-2 shift valve, stem end out, in upper right bore, making certain valve seats in bottom of bore.

20. Install 1-2 regulator valve, larger stem first, spring and 1-2 detent valve, hole end first, into 1-2 modulator bushing, aligning spring in bore of 1-2 detent valve, and install in upper right bore of control valve body.

21. Compress bushing against spring and secure with retaining pin from cored side of control valve body.

22. Install governor oil feed screen assembly in governor oil feed hole in control valve assembly, Fig. 7-52.

NOTE: Screen is held in place by governor feed pipe when installed on the transmission case.

23. Install manual valve with detent pin groove to the right.

i. Rear Servo Assembly (Fig. 7-53)

Disassembly

1. Remove rear accumulator piston from rear servo piston.

2. Remove E-ring retaining rear servo piston to band apply pin.

3. Remove rear servo piston and seal from band apply pin.

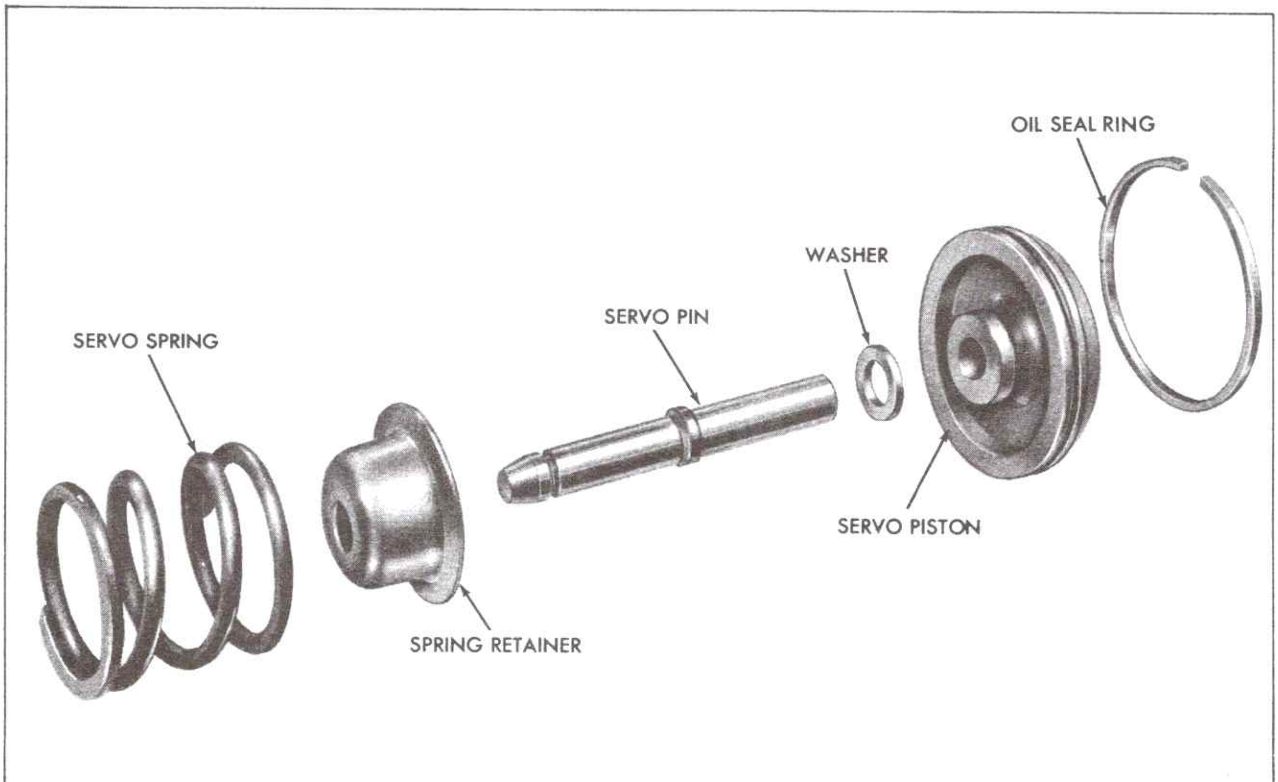


Fig. 7-54 Front Servo Disassembled

4. Remove washer, spring and retainer.

Inspection

1. Inspect fit of oil seal rings in accumulator piston. Clearance between side of ring and groove should be free with a maximum clearance of .003 inch.

2. Install accumulator oil seal ring in case bore and check fit of ring to bore.

3. Inspect fit of band apply pin in servo piston.

4. Inspect band apply pin for scores or cracks.

5. Inspect band apply pin for proper size as determined by pin selection check (Note 16g).

Assembly

1. Install retainer with cup side toward servo pin spring and washer on band apply pin.

2. Install servo piston on pin and secure with E-ring retainer.

3. If removed, install oil seal ring on servo piston.

4. If removed, install outer and inner oil rings on accumulator piston.

5. Install accumulator piston into bore of servo piston.

j. Front Servo Assembly (Fig. 7-54)

Inspection

1. Inspect servo pin for damage.

2. Inspect piston for damaged oil ring groove, check freedom of ring in groove.

3. Inspect piston for cracks or porosity.

4. Check fit of servo pin in piston.

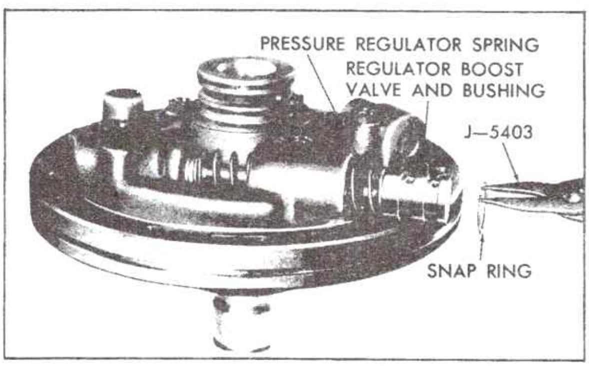


Fig. 7-55 Removing Pressure Regulator Valve Snap Ring

Assembly

1. Reassemble parts of front servo, making sure tapered end of servo pin is pointing through the spring and spring retainer, and install in bore in case.

k. Oil Pump Assembly

NOTE: On service replacement pumps the cooler by-pass valve is not used.

Disassembly

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place pump assembly in Holding Fixture with stator shaft pointing downward. Be careful not to damage shaft.

2. Remove stator solenoid and gasket from pump cover, on AA transmissions.

3. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-55.

CAUTION: Pressure regulator spring is under extreme pressure.

4. Remove regulator boost valve bushing and valve.

5. Remove pressure regulator spring.

6. Remove regulator valve, spring retainer, and spacer or spacers if present.

7. Remove five pump cover attaching screws and remove pump cover from body.

8. Remove drive and driven gears from pump body, Fig. 7-56.

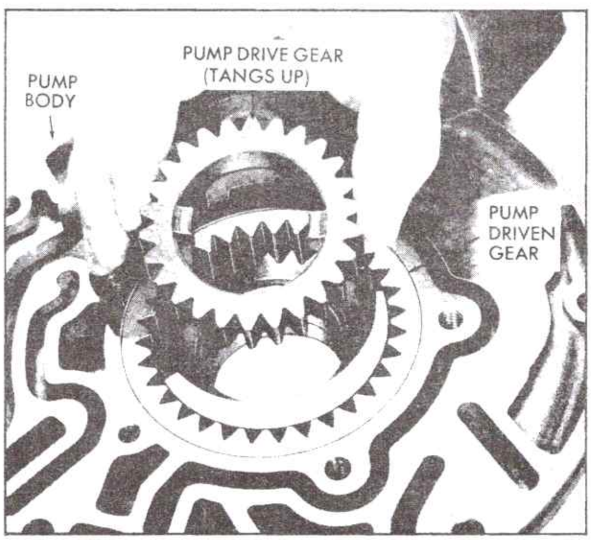


Fig. 7-56 Removing Pump Gears

9. Remove retaining pin and bore plug from end of regulator bore.

NOTE: Steps 10 and 11 apply only to AA transmissions.

10. Remove stator valve retaining pin.

11. Remove stator valve and spring.

12. Remove two oil rings from pump cover.

13. Remove pump to forward clutch housing selective washer (fiber).

14. Remove converter out-check valve from by-pass assembly.

NOTE: Do not remove cooler by-pass valve seat in next step unless replacement of the seat, valve, or spring is necessary.

The sealing qualities of the by-pass valve can be checked by pouring a small quantity of thinner or spirits into valve pocket and checking for excessive leakage.

15. If necessary, remove the cooler by-pass valve seat using Pump Check Valve Seat Remover, J-21361, attached to Slide Hammer, J-6125-1, and Adapter J-6125-2, Fig. 7-57. Install remover tool in valve seat and drive upward on slide hammer to remove valve seat.

NOTE: The seat may also be removed by threading the seat with a 3/8-16 tap and using Adapter J-6125-2 on Slide Hammer, J-6125-1, to drive seat out. If this method is used, flush all foreign material and machining chips out of the by-pass valve bore before installing new seat.

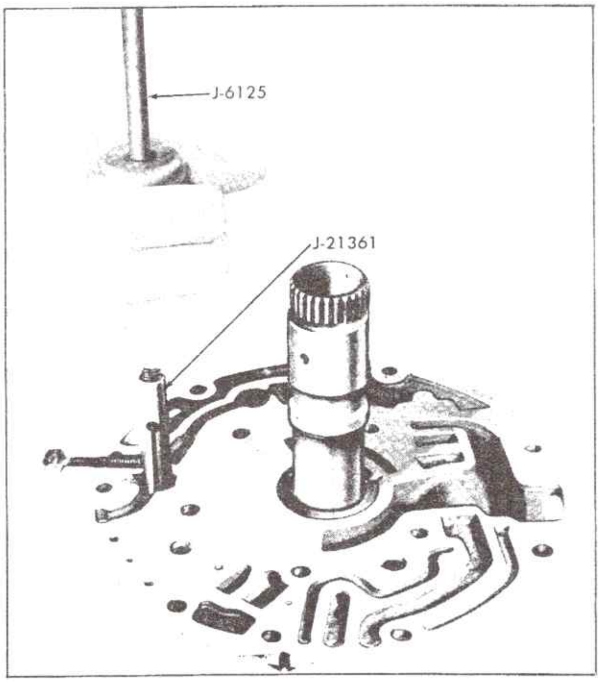


Fig. 7-57 Removing By-Pass Valve Seat

16. Remove by-pass valve and spring.

17. If necessary to replace front oil seal, pry seal from pump body, Fig. 7-29.

Inspection of Pump Body

1. Inspect gear pockets and crescent for scoring, galling or other damage.

2. Place pump gears in pump body and check pump body face to gear face clearance. Clearance should be .0008 inch - .0015 inch, Fig. 7-58.

3. Check face of pump body for scores or nicks.

4. Check oil passages for proper opening and lack of porosity.

5. Check for damaged cover bolt attaching threads.

6. Check for overall flatness of pump body face.

7. Check bushing for scores or nicks.

8. Inspect pump attaching bolt O-ring and coated washers for damage; replace if necessary.

Inspection of Pump Cover (Fig. 7-59)

1. Inspect pump cover face for overall flatness.

2. Check for scores or dirt in pressure regulator bore and stator valve bore.

3. Make certain all passages are open and not interconnected through porosity.

4. Check for scoring or damage at pump gear face.

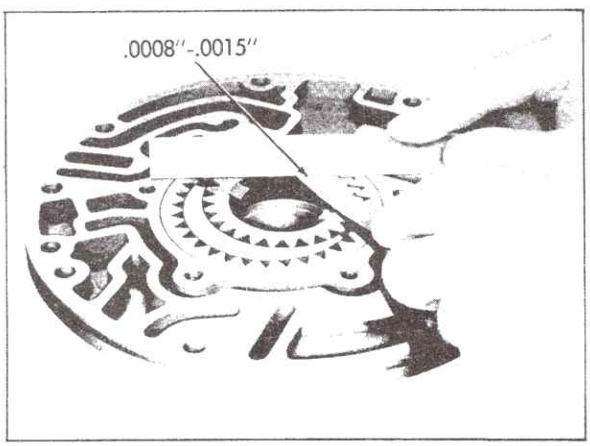


Fig. 7-58 Pump Body Face to Gear Face Clearance

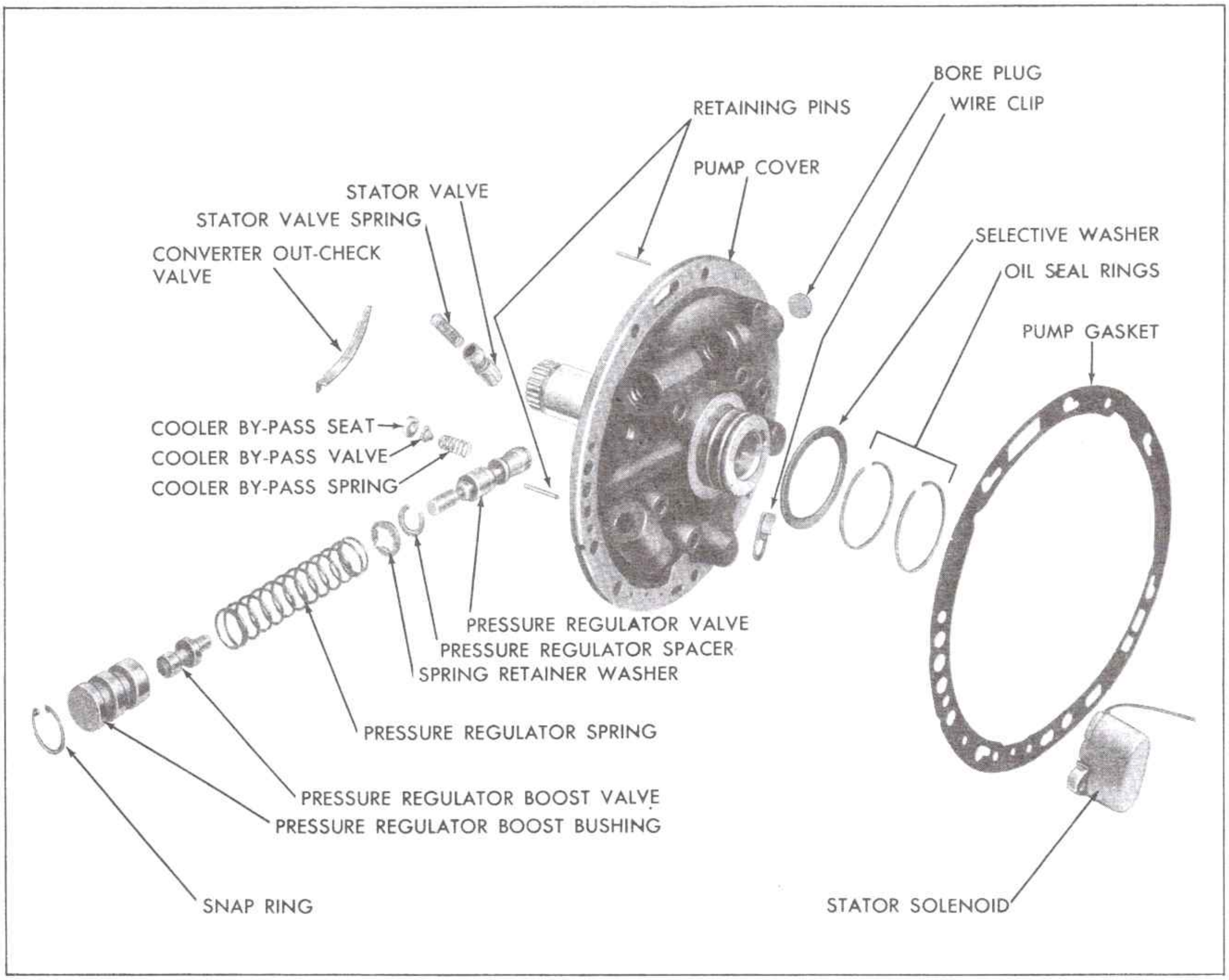


Fig. 7-59 Pump Cover Disassembled

5. Inspect stator shaft for damaged splines, or scored bushings.

6. Inspect oil ring grooves for damage or wear.

7. Inspect cooler by-pass valve for free operation and sealing qualities.

8. Inspect selective washer thrust face for wear or damage.

9. Install pump cover oil rings into counterbore of forward clutch housing and check for proper fit.

10. Inspect pressure regulator and boost valve for free operation.

Assembly

1. Install drive and driven pump gears into pump body with pump drive gear tangs up.

2. Install pressure regulator spacer or spacers, if required, spring retainer, and spring into pressure regulator bore.

3. Install boost valve into bushing, stem end out, and install both parts into pump cover by compressing bushing against spring.

4. Install retaining snap ring.

5. Install pressure regulator valve from opposite end of bore, stem end first.

6. Install pressure regulator valve bore plug and retaining pin into end of bore.

7. Install stator valve and spring into bore in pump cover, and secure with pin.

8. Install previously selected front unit selective thrust washer (fiber) over pump cover delivery sleeve.

NOTE: Proper washer size was determined at time of front unit end play check (Note 16j).

9. Install oil rings.

10. If previously removed, install cooler by-pass valve spring (large end first), valve, and

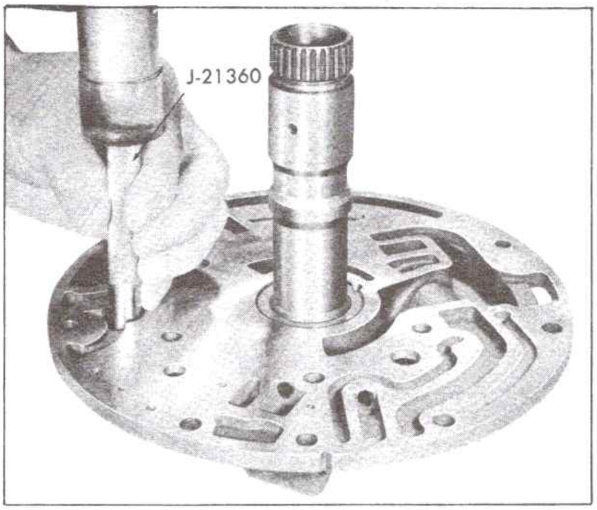


Fig. 7-60 Installing By-Pass Valve Seat

valve seat. Use Pump Check Valve Seat Installer, J-21360, Fig. 7-60, to install valve seat.

11. Install converter out-check valve into by-pass valve assembly.

12. Place pump body in Rear Unit Holding Fixture, J-6116, with stator shaft pointing downward. Be careful not to damage shaft.

13. Lubricate pump gears with transmission fluid and install pump cover on pump body.

14. Install pump cover attaching screws following screw chart, Fig. 7-61. On AA transmissions, intall wire clip on screw next to stator valve. Leave screws one turn loose at this time.

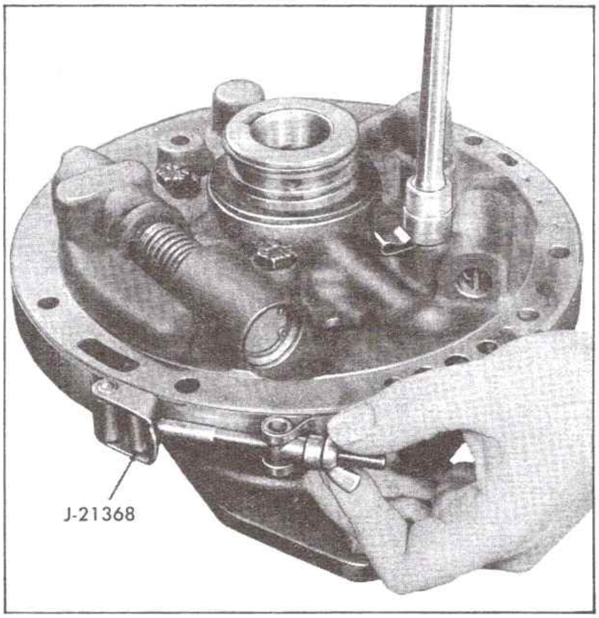


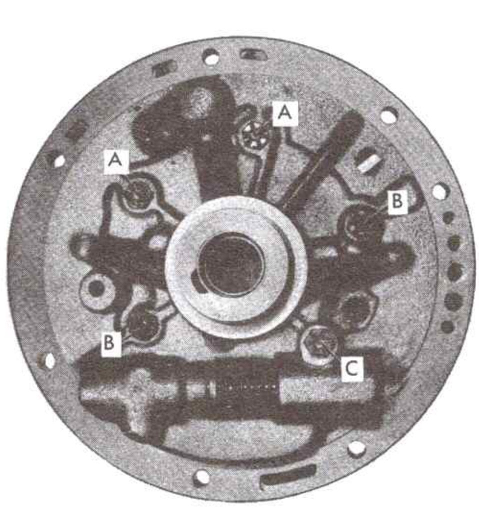
Fig. 7-62 Aligning Pump Cover with Pump Body

15. Install pump Body and Cover Alignment Band, J-21368, around pump assembly. Tighten wing nut on alignment band to align pump cover with pump body, Fig. 7-62.

16. Tighten pump cover attaching screws to 18 foot-pounds and remove alignment band from pump.

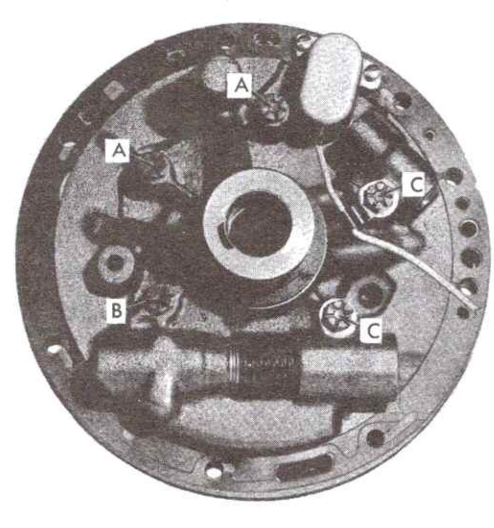
17. Install new square cut O-ring on pump.

18. If necessary, install new pump oil seal using pump Oil Seal Installer, J-21359, Fig. 7-30.



MODELS AB AND AC TRANSMISSIONS

BOLT	SIZE
A -	5/16 - 18 x 1
B -	5/16 - 18 x 1½
C -	5/16 - 18 x 1¾



MODEL AA TRANSMISSIONS

Fig. 7-61 Pump Cover Attaching Screw Chart

19. Install new gasket on oil pump, aligning holes in gasket with corresponding holes in pump cover. Retain gasket with petrolatum.

20. Attach stator solenoid with attaching screws on AA transmission. Tighten screws to 2 to 3 1/2 foot pounds.

21. Attach stator wire to clip.

I. Forward Clutch Assembly—Disassembly

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place forward clutch assembly in Holding Fixture with turbine shaft pointing downward. Be careful not to damage shaft.

2. Remove forward clutch housing to direct clutch hub snap ring.

3. Remove direct clutch hub.

4. Remove forward clutch hub and one thrust washer from each side of hub, Fig. 7-63.

5. Remove five radially grooved composition and five steel clutch plates.

6. Place forward clutch assembly in arbor press with turbine shaft pointing downward.

7. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press and remove snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-64.

8. Remove tools, spring retainer and 16 clutch release springs.

9. Remove forward clutch piston from forward clutch housing.

10. Remove inner and outer seals from clutch piston.

11. Remove center piston seal from forward clutch housing.

12. It is not necessary to remove turbine shaft from forward clutch housing unless either shaft or housing is damaged and must be replaced. In such case proceed as follows:

a. Place forward clutch housing in arbor press with turbine shaft pointing downward.

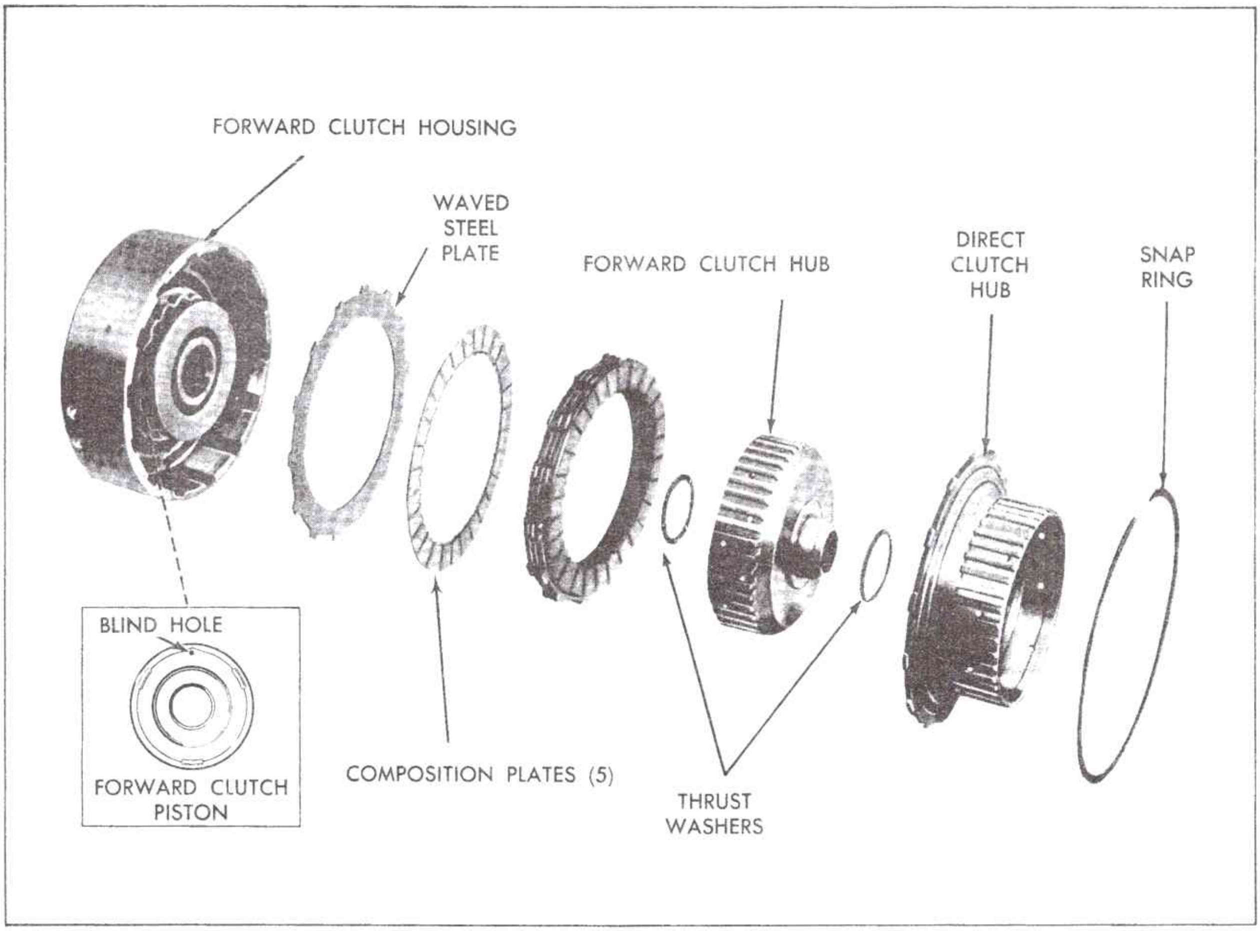


Fig. 7-63 Forward Clutch and Forward and Direct Clutch Hubs Disassembled

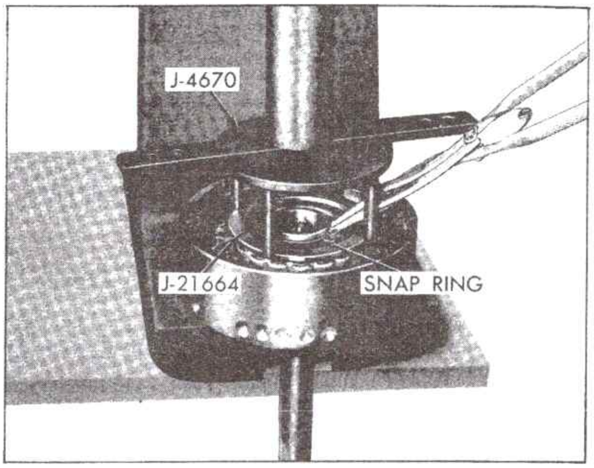


Fig. 7-64 Removing and Installing Forward Clutch Housing Snap Ring

b. Using 3/8 inch drive extension approximately 3 inches long, or similar tool as driver, press turbine shaft out of forward clutch housing.

NOTE: Turbine shaft used on transmissions equipped with variable pitch stator have lubrication holes drilled in different locations than those without variable pitch; therefore, turbine shafts are not interchangeable. The wrong shaft will retard lubrication of the unit and cause premature failure.

Inspection

1. Inspect drive and driven clutch plates for signs of burning, scoring or wear.

2. Inspect sixteen release springs for collapsed coils or signs of distortion.

3. Inspect clutch hubs for worn splines, proper lubrication holes, and thrust faces.

4. Inspect piston for cracks.

5. Inspect clutch housing for wear, scoring, cracks and open oil passages.

6. Inspect operation of ball check in forward clutch housing.

7. Inspect turbine shaft for open lubrication passages at each end.

8. Inspect turbine shaft splines for damage.

9. Inspect bushing journals for damage.

10. Inspect turbine shaft for cracks or distortion.

Assembly

1. If turbine shaft was previously removed from forward clutch housing proceed as follows:

a. Place forward clutch housing on arbor press with flat side up.

b. Align shorter splined end of turbine shaft with splines in forward clutch housing, and using arbor press, carefully press shaft into housing until shaft bottoms on hub of housing.

CAUTION: Start shaft into housing and back off on arbor press to allow shaft to straighten itself. Repeat this step several times until you are certain shaft is going in straight, otherwise, shaft or housing splines may be damaged.

2. Invert forward clutch housing on arbor press with turbine shaft pointing downward.

3. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in forward clutch piston with petrolatum and install seals with lips facing away from spring pockets.

NOTE: The forward and direct clutch pistons have identical inside and outside diameters. Therefore, extreme care should be exercised during reassembly to assure the proper piston be installed in the clutch assemblies.

The forward clutch piston can be identified by the absence of a check ball in the clutch apply face of the piston.

4. Lubricate new center piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and install seal into clutch housing with lip facing up.

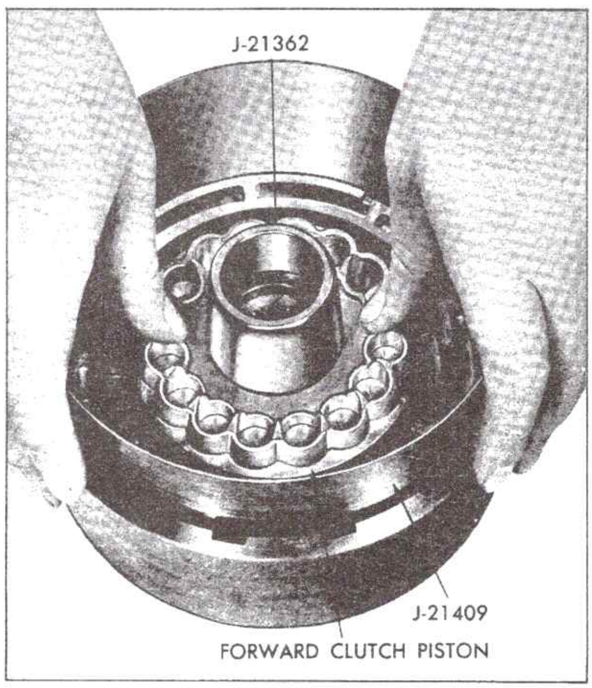


Fig. 7-65 Installing Forward Clutch Piston

5. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over forward clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in forward clutch housing, Fig. 7-65, and install clutch piston by rotating it slightly in a clockwise direction until seated.

6. Install sixteen clutch release springs into spring pockets in clutch piston.

NOTE: Forward clutch release springs are dyed green and are not interchangeable with the red colored springs used in the direct clutch piston.

7. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press, being careful that retainer does not catch in snap ring groove, and install snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-64. Remove tools.

CAUTION: Make certain clutch release springs are not leaning. If necessary, straighten with a small screwdriver.

8. Remove forward clutch assembly from arbor press and place in Holding Fixture, J-6116, with turbine shaft pointing down. Be careful not to damage shaft.

9. Install phenolic thrust washer on the outside of forward clutch hub. The larger washer is installed on side of hub facing forward clutch housing.

10. Install forward clutch hub in forward clutch housing.

11. Lubricate the four flat steel, five radially grooved composition and one waved U-notched steel clutch plates with transmission fluid and install clutch plates in forward clutch housing, Fig. 7-63. Start with waved steel plate and alternate composition and steel plates.

NOTE: Be sure radially grooved composition plates are used only in the forward clutch.

12. Install direct clutch hub in forward clutch housing over clutch plates, and install snap ring.

13. Place forward clutch housing on pump delivery sleeve and air check clutch operation by applying air through forward clutch passage in pump, Fig. 7-66, to actuate piston and move forward clutch.

m. Direct Clutch and Intermediate Sprag Assembly (Fig. 7-67)

Disassembly

1. Remove sprag retainer snap ring, and remove clutch retainer.

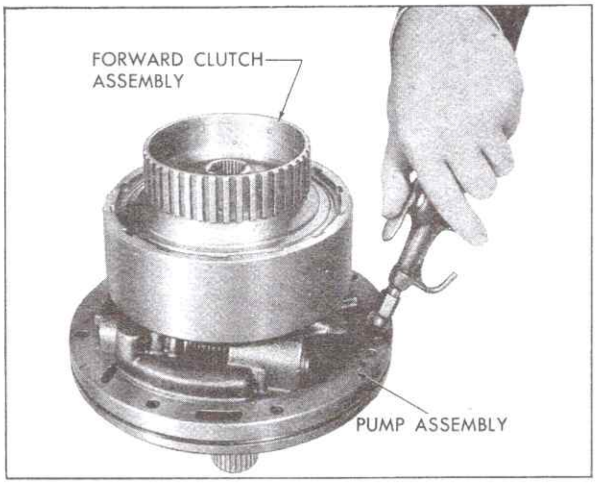


Fig. 7-66 Air Checking Forward Clutch

2. Remove sprag outer race and bushings, and remove sprag assembly from outer race.

3. Turn unit over and remove direct clutch backing plate to clutch housing snap ring.

4. Remove direct clutch backing plate and five composition and five steel clutch plates, Fig. 7-68.

5. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-69, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.

6. Remove tools, spring retainer, and sixteen clutch release springs.

7. Remove direct clutch piston from direct clutch housing.

8. Remove inner and outer seals from clutch piston.

9. Remove center piston seal from direct clutch housing.

Inspection

1. Inspect sprag assembly for popped or loose sprags.

2. Inspect sprag bushing for wear or distortion.

3. Inspect inner and outer races for scratches or wear.

4. Inspect clutch housing for cracks, wear, proper opening of oil passages and wear on clutch plate drive lugs.

5. Inspect drive and driven clutch plates for sign of wear or burning.

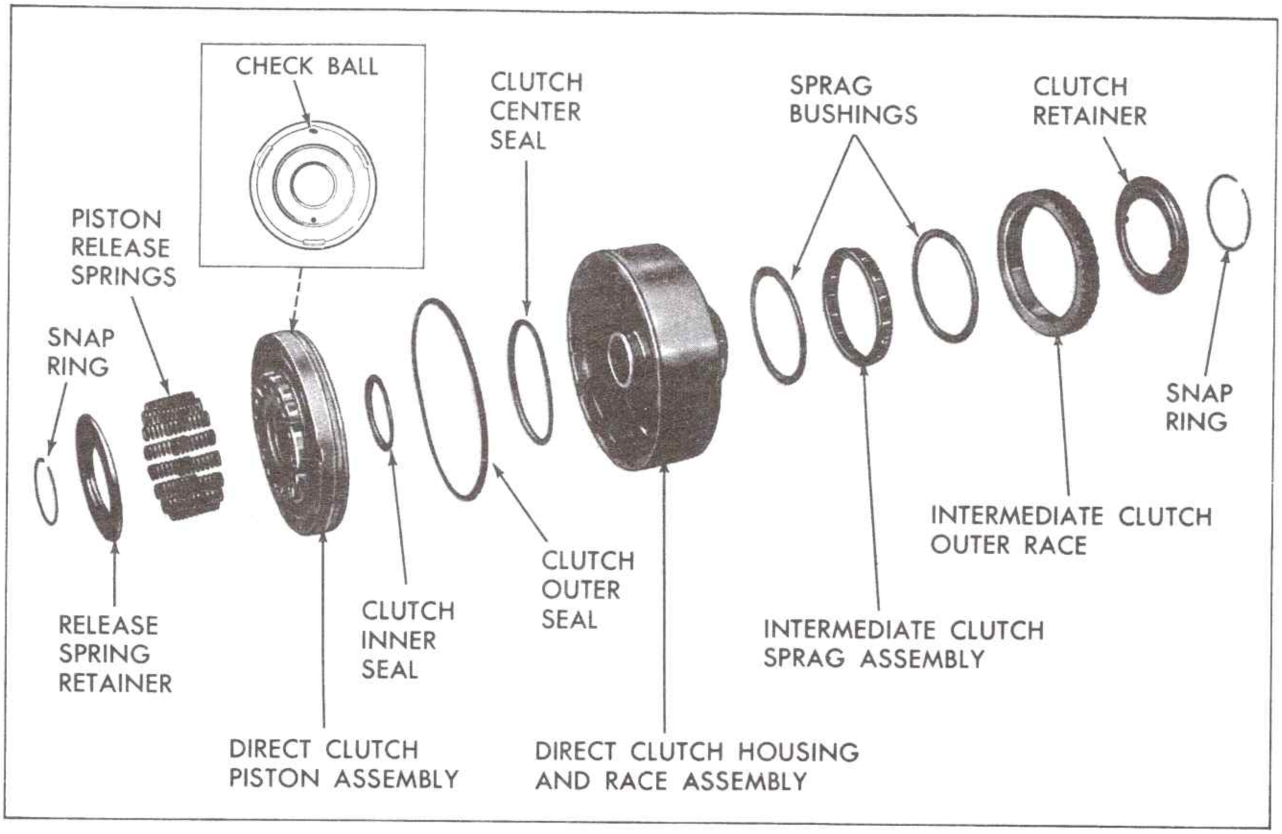


Fig. 7-67 Direct Clutch and Piston Disassembled

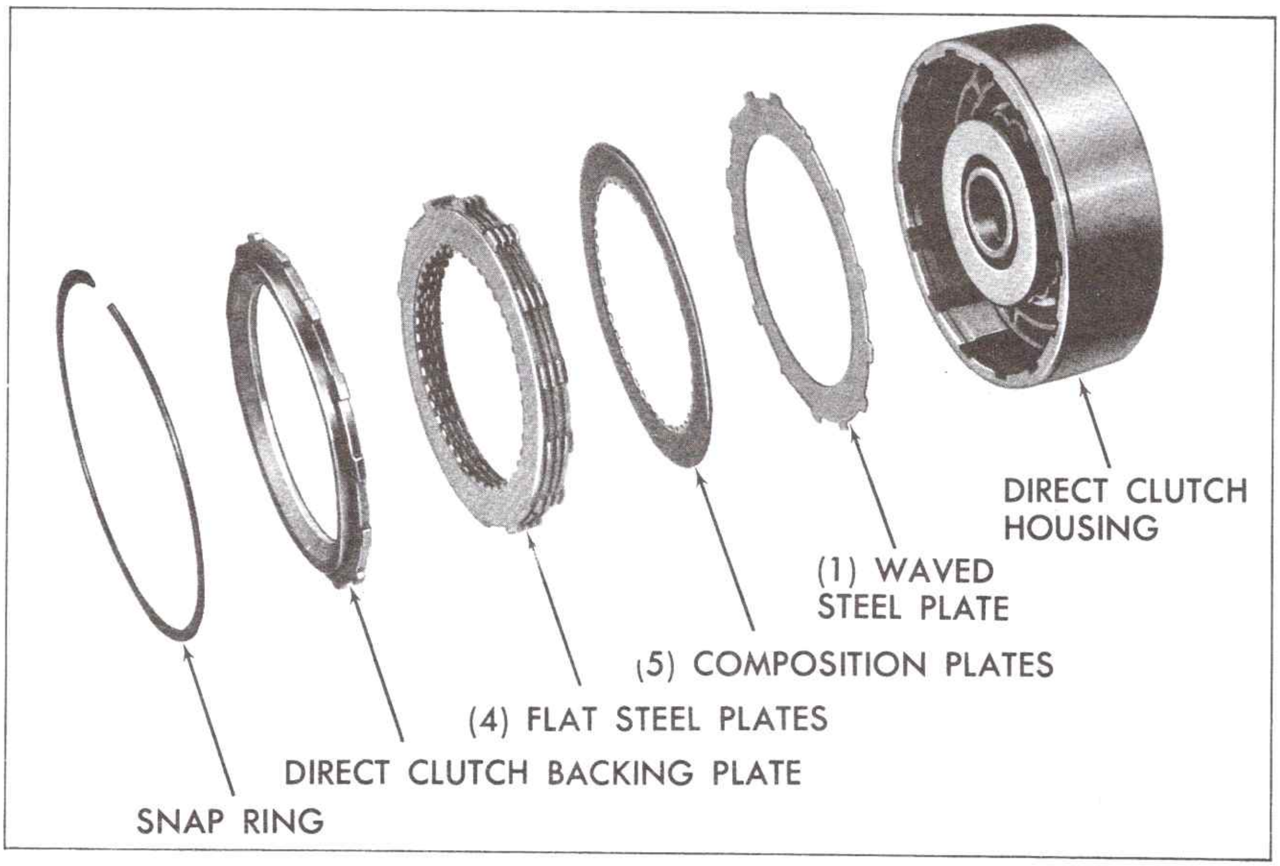


Fig. 7-68 Direct Clutch Disassembled

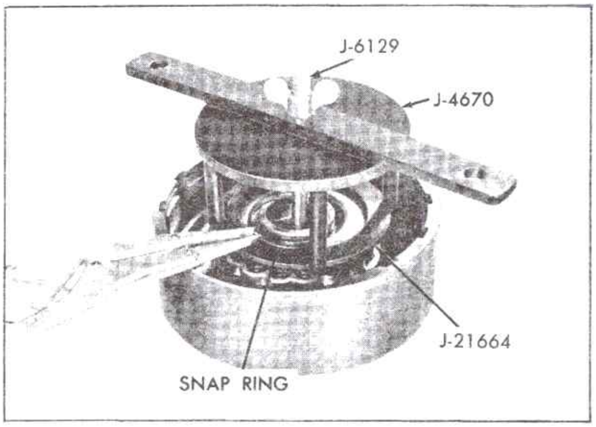


Fig. 7-69 Removing and Installing Direct Clutch Housing Snap Ring

6. Inspect backing plate for scratches or other damage.

7. Inspect piston for cracks and free operation of ball check.

8. Inspect springs for collapsed coils or signs of distortion.

Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in direct clutch piston and install seals with lips facing away from spring pockets.

NOTE: Make certain piston has ball check.

2. Lubricate new center seal with transmission fluid. Lubricate seal groove in direct clutch housing and install seal in clutch housing with lip facing up.

3. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over direct clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in direct clutch housing, Fig. 7-70, and install clutch piston by rotating it slightly, in a clockwise direction.

4. Install 16 clutch release springs into spring pockets in clutch piston.

NOTE: Direct clutch release springs are red in color and are not interchangeable with the green colored springs used in the forward clutch piston.

5. Place spring retainer and snap ring over springs.

6. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-69, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

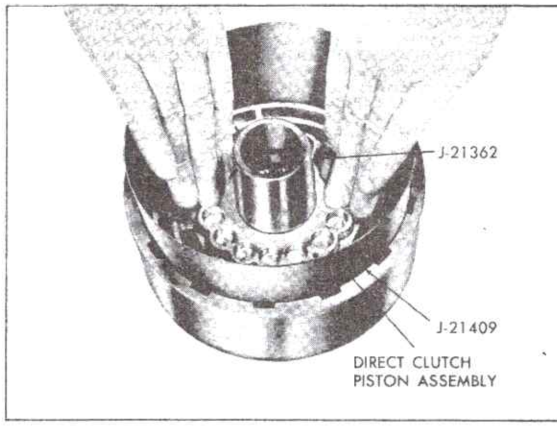


Fig. 7-70 Installing Direct Clutch Piston

NOTE: Make certain clutch release springs are not leaning. If necessary, straighten springs with a small screwdriver.

7. Lubricate the four flat and one waved U-notched steel and five composition clutch plates with transmission fluid and install clutch plates in direct clutch housing Fig. 7-71. Start with waved steel plate and alternate composition and steel plates.

NOTE: Do not use radially grooved composition plates here.

8. Install direct clutch backing plate over clutch plates and install backing plate snap ring.

9. Invert clutch housing and install one sprag bushing, cup side up, around sprag inner race.

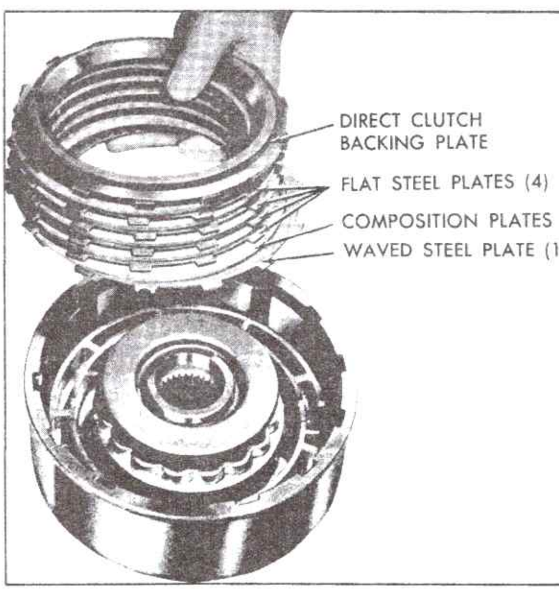


Fig. 7-71 Installing Direct Clutch Plates

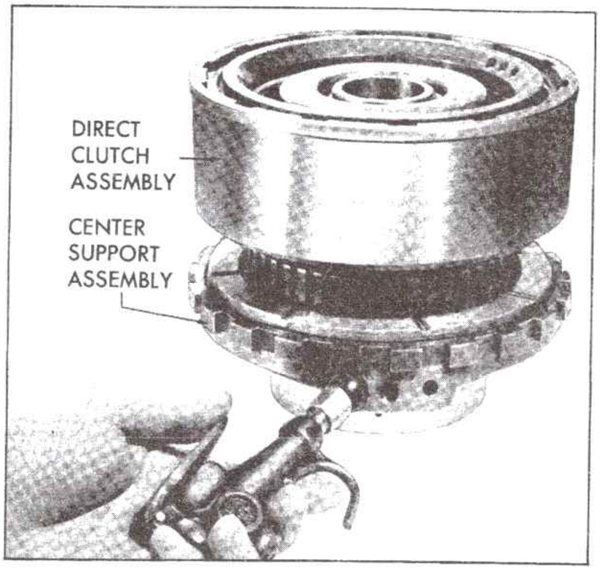


Fig. 7-72 Air Checking Direct Clutch

10. Install sprag assembly into clutch outer race.

11. With ridge on inner cage of sprag facing down, install sprag and outer race on inner race with clockwise turning motion.

NOTE: When installed, outer race should not turn counterclockwise.

12. Install sprag bushing, cup side down, over sprag assembly.

13. Install sprag retainer and snap ring.

14. Place direct clutch assembly on center support and air check operation of direct clutch, Fig. 7-72.

NOTE: If air is applied through reverse passage, (right oil feed hole) it will escape from direct clutch passage (left oil feed hole).

This is considered normal. Also, apply air through left oil feed hole to actuate piston and move direct clutch.

n. Center Support and Intermediate Clutch Piston

Disassembly (Fig. 7-73)

1. Remove four oil seal rings from center support.

2. Using Clutch Spring Compressor, J-4670, and Rear Clutch Spring Compressor, J-6129, Fig. 7-74, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.

3. Remove tools, spring retainer, and three intermediate clutch release springs.

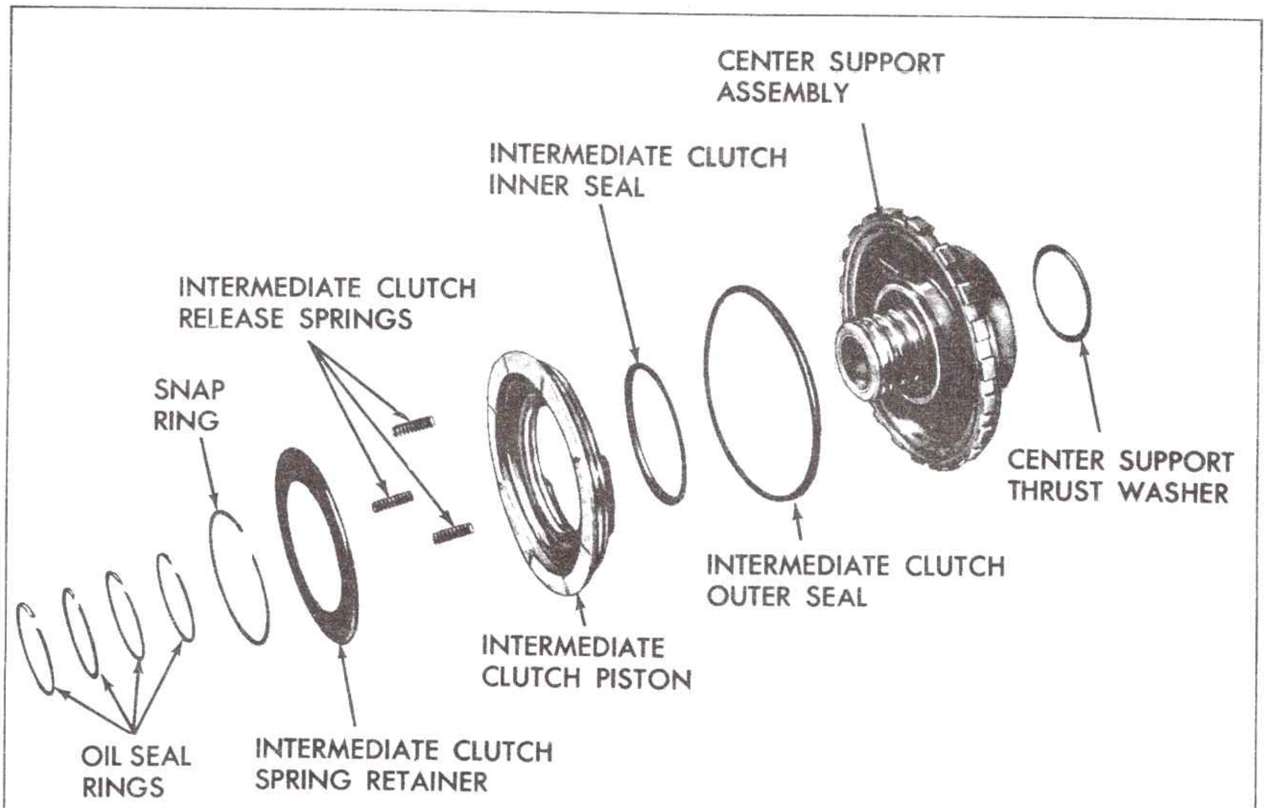


Fig. 7-73 Center Support Assembly Disassembled

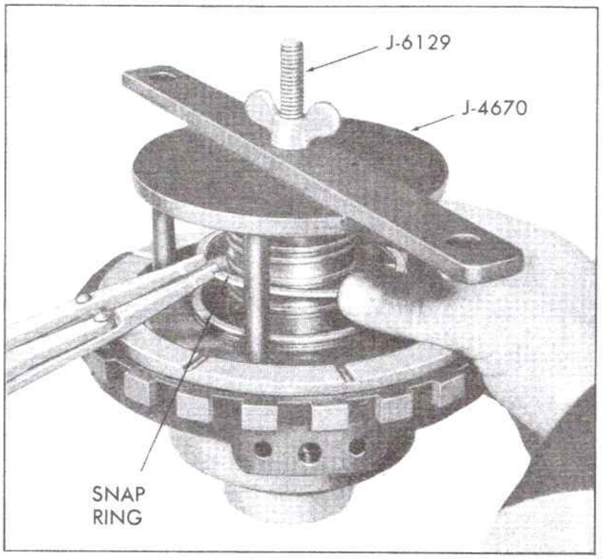


Fig. 7-74 Removing and Installing Intermediate Clutch Piston Snap Ring

4. Remove intermediate clutch piston from center support.

5. Remove inner and outer seals from clutch piston.

NOTE: Do not remove the three screws retaining roller clutch inner race to center support.

Inspection

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.

2. Inspect bushing for scoring, wear or galling.

3. Check oil ring grooves for damage.

4. Air check oil passages to be sure they are open and not interconnected.

5. Inspect piston sealing surfaces for scratches.

6. Inspect piston seal grooves for nicks or other damages.

7. Inspect piston for cracks or porosity.

8. Inspect springs for collapsed coils or signs of distortion.

Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in intermediate clutch piston and install seals with lips facing away from spring pockets.

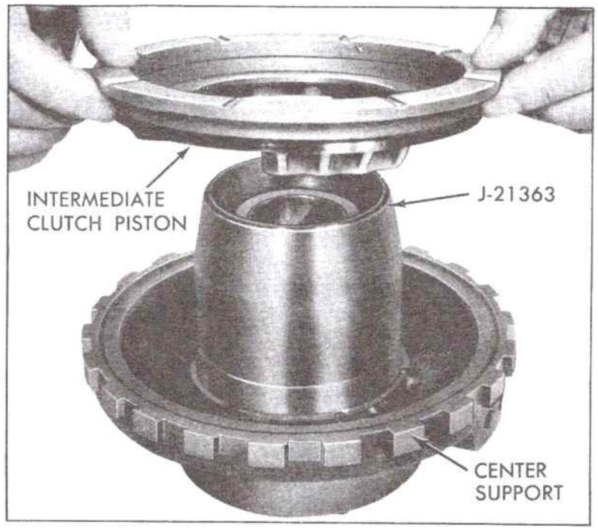


Fig. 7-75 Installing Intermediate Clutch Piston

2. Place Intermediate Clutch Inner Seal Protector, J-21363, over center support hub, Fig. 7-75, and install intermediate clutch piston.

3. Install three clutch release springs into spring pockets in clutch piston, spacing springs equally around clutch piston.

4. Place spring retainer and snap ring over springs.

5. Using Clutch Spring Compressor, J-4670, and Rear Clutch Spring Compressor, J-6129, Fig. 7-74, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

6. Install four new oil seal rings on center support.

7. Air check operation of intermediate clutch piston. Apply air through center oil feed hole to actuate clutch piston, Fig. 7-76.

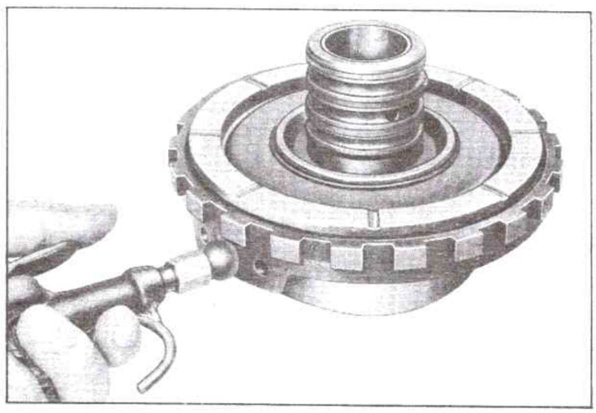


Fig. 7-76 Air Checking Intermediate Clutch

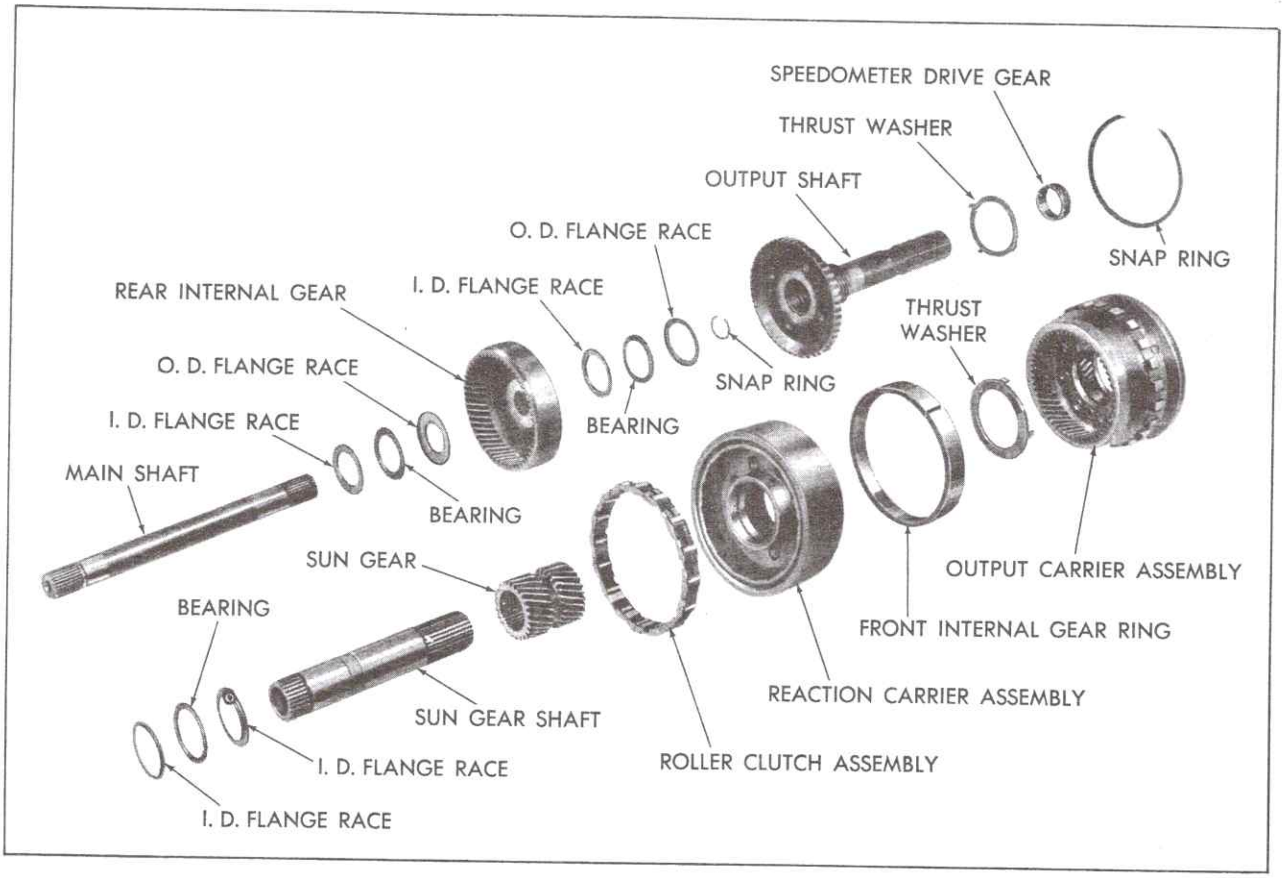


Fig. 7-77 Gear Unit Assembly Disassembled

o. Gear Unit (Fig. 7-77)

Disassembly of Gear Unit

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place gear unit in Holding Fixture with output shaft pointing downward.

2. Remove center support to sun gear races and thrust bearing.

NOTE: Outer race may have stuck to center support when it was removed.

3. Remove sun gear from output carrier assembly.

4. Invert gear unit in Holding Fixture with main shaft pointing downward.

5. Remove snap ring securing output shaft to output carrier and remove output shaft. Remove O-ring from output shaft and discard.

6. Remove thrust bearing and races from rear internal gear.

7. Lift rear internal gear and main shaft out of output carrier and remove thrust bearing and races from inner face of rear internal gear.

8. Remove snap ring from end of main shaft and remove rear internal gear.

9. Remove output carrier from Holding Fixture.

Inspection of Output Shaft

1. Inspect case bushing for wear or galling.

2. Inspect bearing and thrust washer surfaces for damage.

3. Inspect governor drive gear for rough or damaged teeth.

4. Inspect splines for damage.

5. Inspect orificed cup plug in the lubrication passage.

6. Inspect drive lugs for damage.

7. Inspect speedometer drive gear for rough or damaged teeth. If replacement of drive gear is necessary, proceed as follows:

Speedometer Drive Gear Replacement

1. Install Speedometer Drive Gear Remover, J-21427, with Pulley Puller, J-8433, and attach,

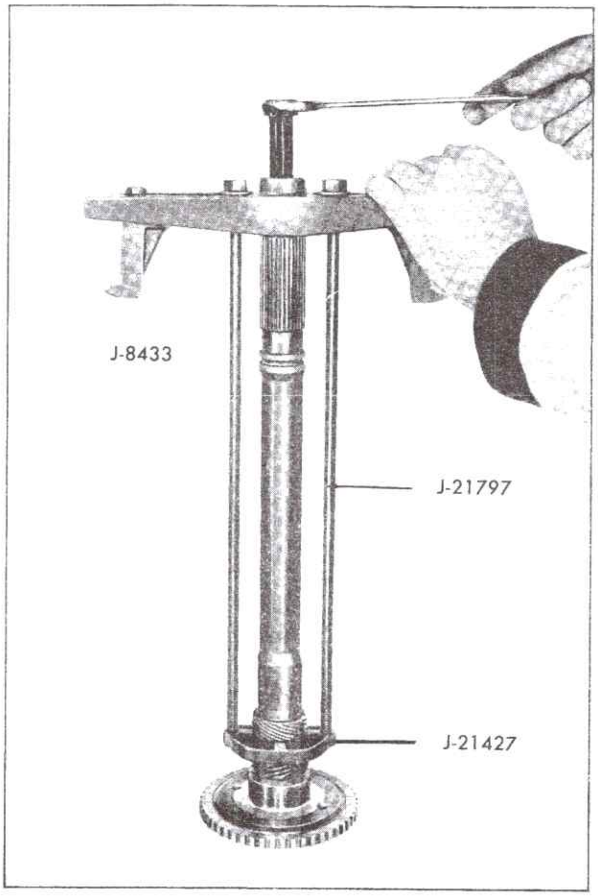


Fig. 7-78 Removing Speedometer Drive Gear

using Speedometer Drive Gear Remover Bolts, J-21797, on output shaft so that puller bolt indexes with end of shaft and flat face of remover tool is under front face of drive gear.

2. Tighten bolt on Pulley Puller, Fig. 7-78, until gear is free on shaft. Remove tools and gear from shaft.

3. Support output shaft and install new drive gear using a piece of pipe.

CAUTION: Use a pipe that closely fits output shaft and does not contact gear teeth. Contact with the gear teeth would result in damage to the gear as it is driven into place.

4. Drive gear onto shaft until distance from rear face of gear to end of output shaft is 15 inches, Fig. 7-79.

Inspection of Main Shaft

1. Inspect shaft for cracks or distortion.

2. Inspect splines for damage.

3. Inspect ground bushing journals for damage.

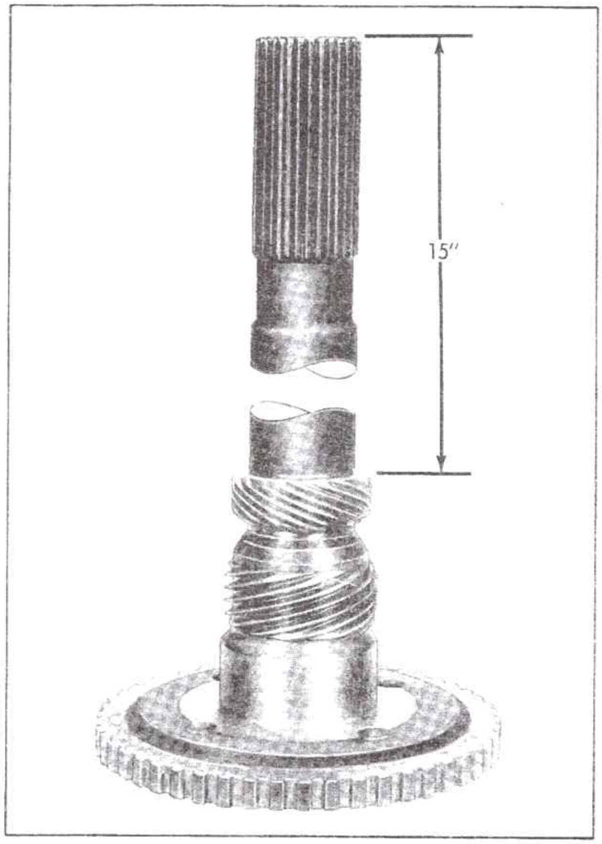


Fig. 7-79 Speedometer Drive Gear Installed

4. Inspect snap ring groove for damage.

5. Inspect orificed cup plug in end of main shaft. Be sure it is not plugged.

Inspection of Rear Internal Gear

1. Inspect gear teeth for damage or wear.

2. Inspect splines for damage.

3. Inspect gear for cracks.

Inspection of Output Carrier Assembly

1. Inspect front internal gear for damaged teeth.

2. Inspect pinion gears for damage, rough bearings or excessive tilt.

3. Check pinion end play. Pinion end play should be .009 inch - .024 inch, Fig. 7-80.

4. Inspect parking gear lugs for cracks or damage.

5. Inspect output shaft locating splines for damage.

6. Inspect front internal gear ring for flaking or cracks.

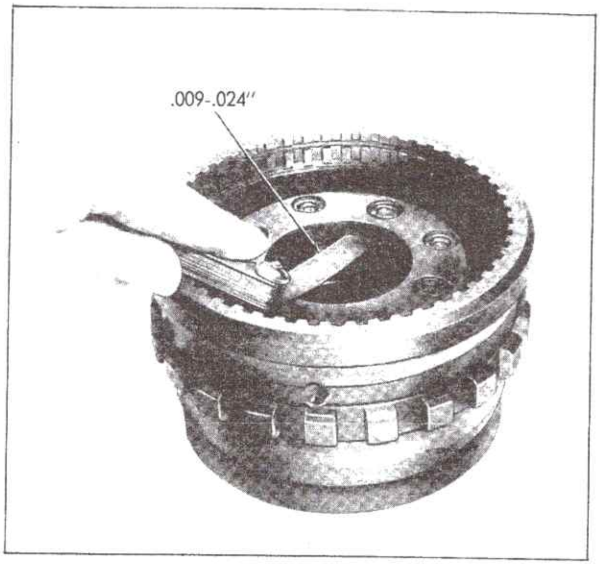


Fig. 7-80 Checking Output Carrier Pinion End Play

Inspection of Reaction Carrier Assembly

1. Inspect band surface on reaction carrier for signs of burning or scoring.

2. Inspect roller clutch outer cam for scoring or wear.

3. Inspect thrust washer surfaces for signs of scoring or wear.

4. Inspect bushing for damage. If bushing is damaged, carrier must be replaced.

5. Inspect pinion gears for damage, rough bearings or excessive tilt.

6. Check pinion end play. Pinion end play should be .009 inch - .024 inch.

Pinion Gear Replacement—Reaction and Output Carrier Assemblies

1. Support carrier assembly on its FRONT face.

2. Using a tapered punch, drive or press pinion pins out of carrier.

3. Remove pinion gears, thrust washers, and roller needle bearings.

4. Inspect pinion pocket thrust faces for burrs and remove if present.

5. Install nineteen needle bearings into each pinion gear using petrolatum to hold bearings in place. Use a pinion pin as a guide.

6. Place a bronze and steel thrust washer on each side of pinion gear with steel washers against gear, Fig. 7-81. Hold washers in place with petrolatum.

7. Place pinion gear assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.

8. Drive a new pinion pin into place from the front, while rotating pinion gear. Be sure that headed end is flush or below face of carrier.

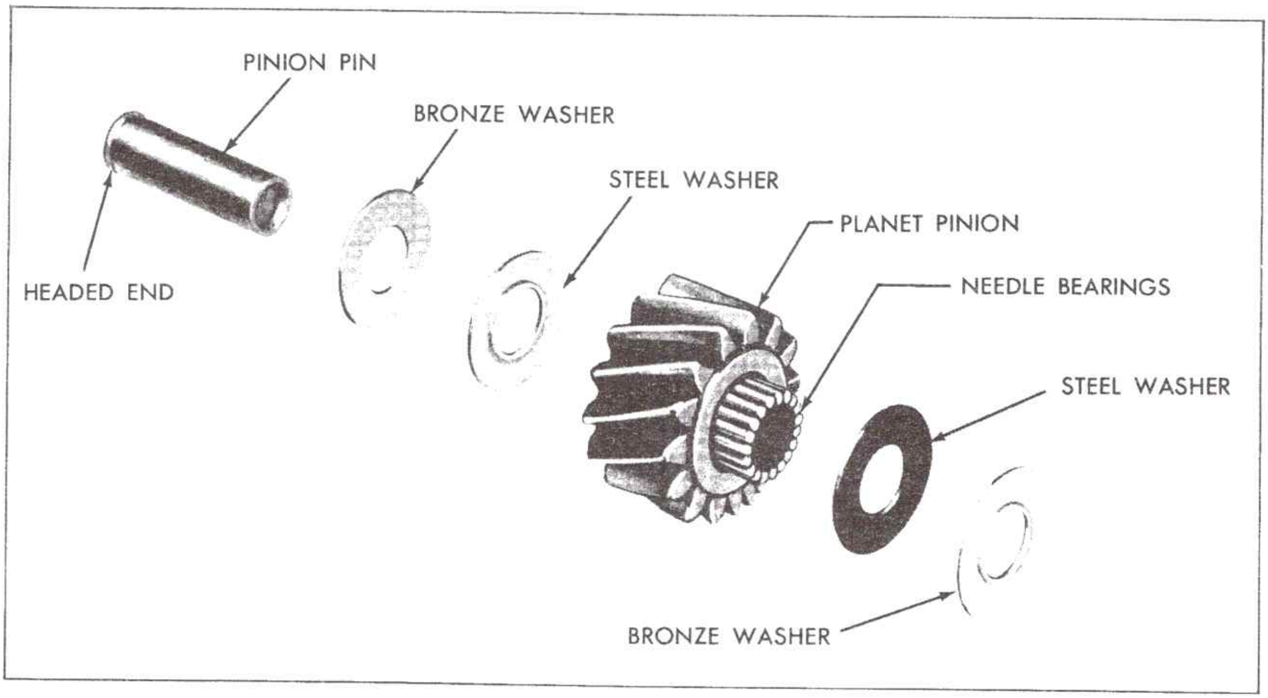


Fig. 7-81 Planet Pinion Assembly Disassembled

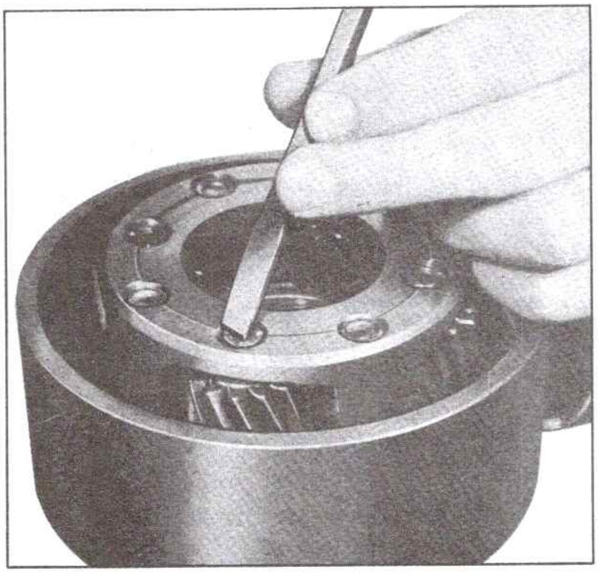


Fig. 7-82 Staking Pinion Pin

9. Using a punch in bench vise for an anvil, stake opposite end of pinion pin in three places with a blunt radius chisel, Fig. 7-82.

NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.

10. Repeat installation procedure for each pinion gear.

Inspection of Roller Clutch Assembly

1. Inspect roller clutch for damaged rollers or springs.

2. Inspect roller clutch cage for damage.

Inspection of Sun Gear

1. Inspect gear teeth for damage or wear.

2. Inspect splines for damage.

3. Be sure oil lubrication hole is open.

Inspection of Sun Gear Shaft

1. Inspect shaft for cracks or splits.

2. Inspect splines for damage.

3. Inspect bushings for scoring or galling.

4. Inspect ground bushing journals for damage.

5. Be sure oil lubrication hole is open.

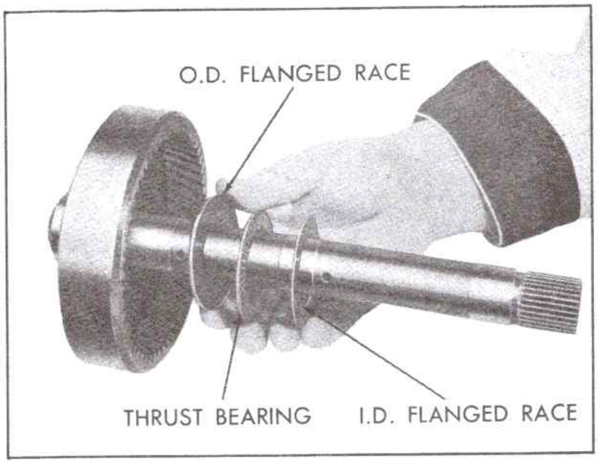


Fig. 7-83 Installing Races and Thrust Bearing on Inner Face of Rear Internal Gear

Assembly of Complete Gear Unit

1. Install rear internal gear on end of main shaft that has snap ring groove and install snap ring.

2. Install races and thrust bearing on inner face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:

a. Install large diameter race first, with flange facing up, Fig. 7-83.

b. Install thrust bearing in race.

c. Install small diameter race on bearing with inner flange facing down.

3. Lubricate pinion gears in output carrier with transmission fluid and install output carrier

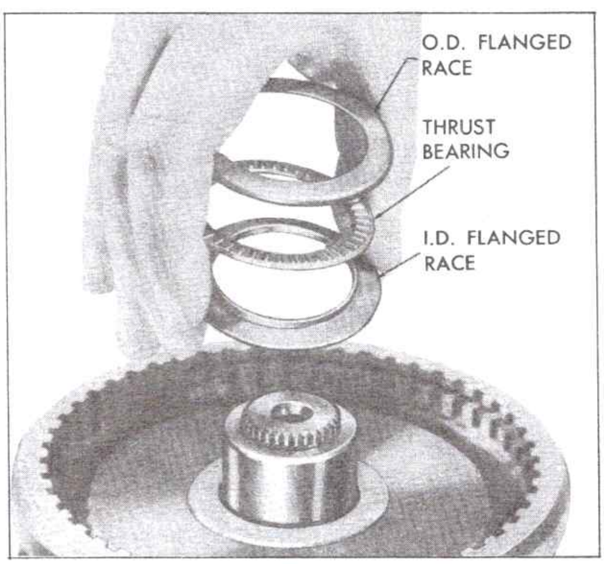


Fig. 7-84 Installing Races and Thrust Bearing on Outer Face of Rear Internal Gear

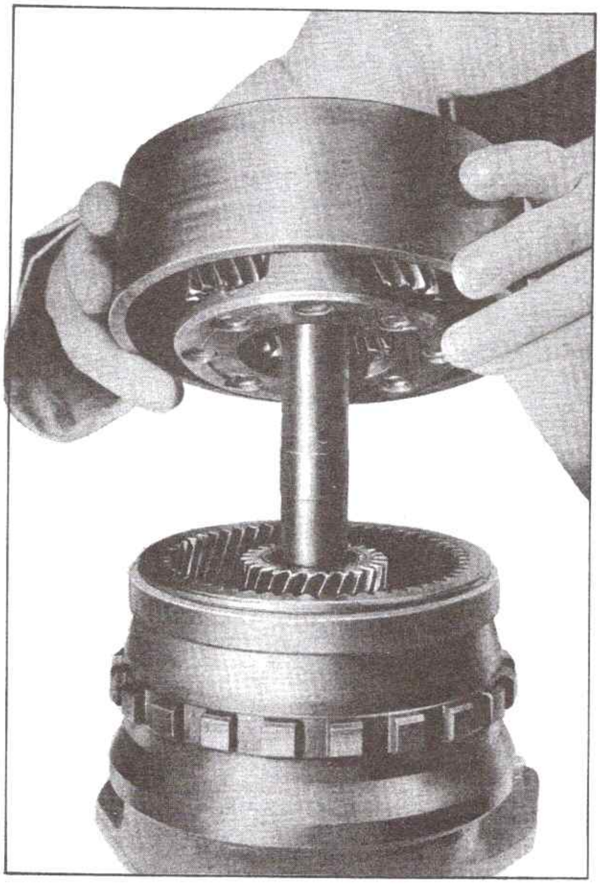


Fig. 7-85 Installing Reaction Carrier on Output Carrier

on main shaft so that pinion gears mesh with rear internal gear.

4. Place assembly in Rear Unit Holding Fixture, J-6116, with main shaft pointing downward. Be careful not to damage shaft.

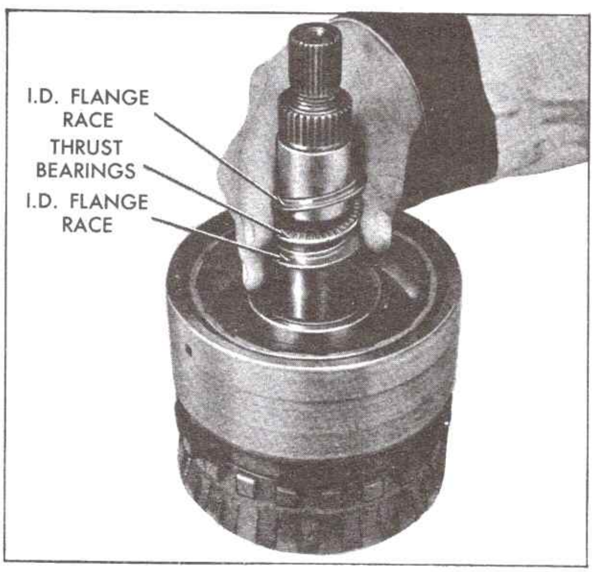


Fig. 7-86 Installing Center Support Races and Thrust Bearing at Sun Gear

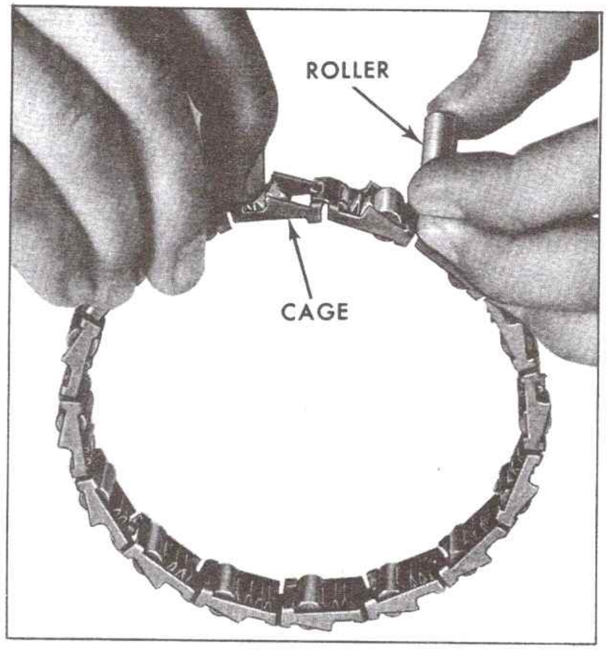


Fig. 7-87 Installing Roller in Roller Clutch Cage

5. Install races and thrust bearing on outer face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:

a. Install small diameter (flanged I.D.) race first, with flange facing up, Fig. 7-84.

b. Install thrust bearing in race.

c. Install large diameter (flanged O.D.) race on bearing with flange cupped over bearing.

6. Install output shaft into output carrier and install snap ring with bevel edge up. Install new O-ring on output shaft.

7. Invert assembly in Holding Fixture with output shaft pointing downward.

8. Lubricate tab side of thrust washer with petrolatum and install thrust washer in output carrier with bent tabs in tab pockets.

9. Install sun gear with end having chamfered I.D. facing down.

10. Install sun gear shaft with longer splined end down.

11. Install ring over output carrier.

12. Lubricate pinion gears in reaction carrier with transmission fluid and install reaction carrier on output carrier, Fig. 7-85, so that pinion gears mesh with front internal gear.

13. Install large diameter O.D. race on sun gear with flange facing up against sun gear shaft.

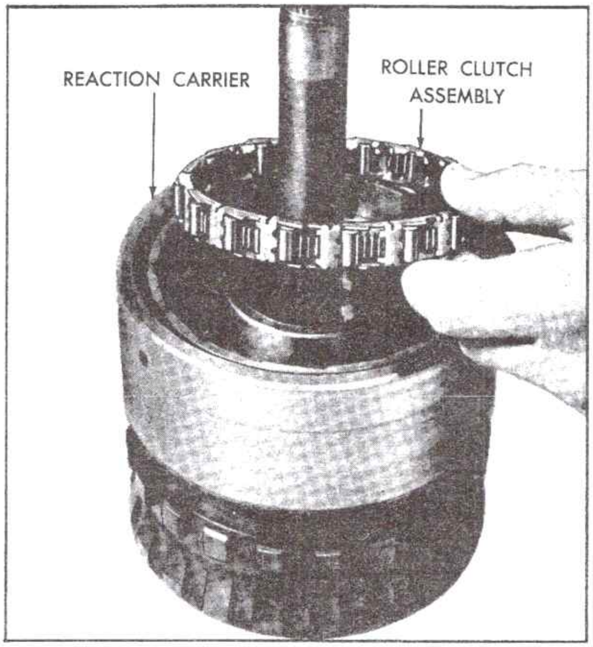


Fig. 7-88 Installing Roller Clutch in Reaction Carrier

14. Install thrust bearing on race.

15. Lubricate small diameter race with petrolatum and install race on center support with flange facing up, Fig. 7-86.

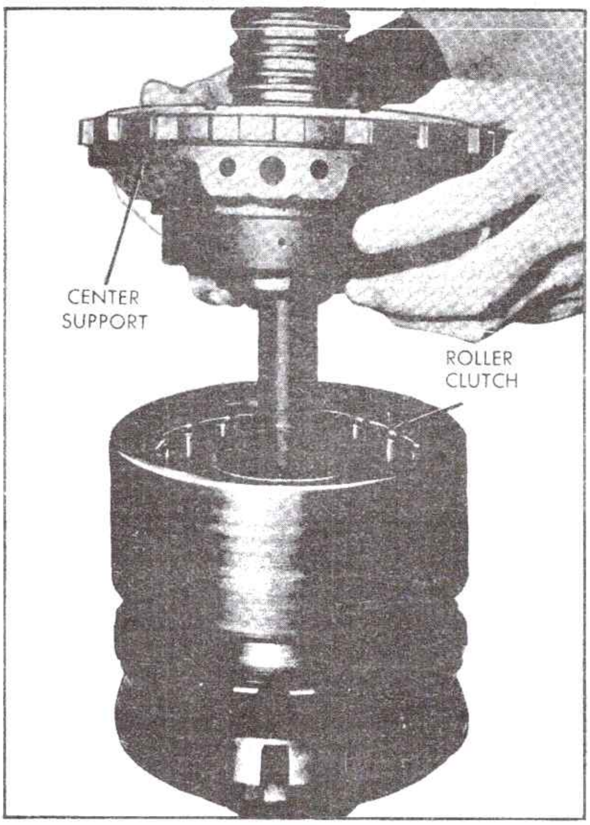


Fig. 7-89 Installing Center Support in Reaction Carrier

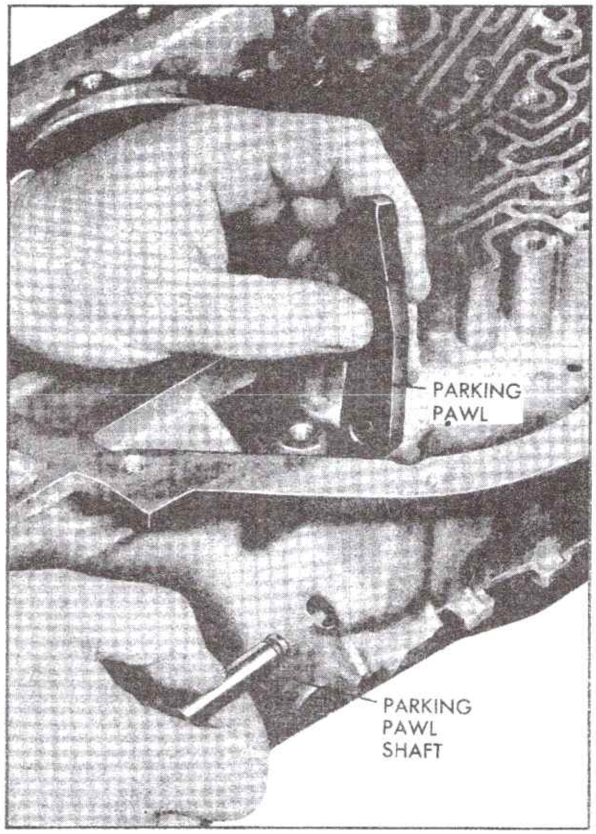


Fig. 7-90 Installing Parking Pawl and Shaft

16. Lubricate phenolic thrust washer with petrolatum and install washer in recess in center support.

17. Install rollers that may have come out of roller clutch cage, by compressing energizing spring with forefinger and inserting roller from outer side, Fig. 7-87.

NOTE: Make certain that energizing springs are not distorted, and that curved end leaf of springs are positioned against rollers.

18. Install roller clutch assembly in reaction carrier, Fig. 7-88.

19. Install center support assembly into roller clutch in reaction carrier, Fig. 7-89.

NOTE: With reaction carrier held, center support should turn counterclockwise only.

20. Install Tool, J-21365, on end of main shaft so that tangs engage groove in shaft. Tighten screw on tool to secure tool on shaft and prevent movement of the roller clutch during installation of the gear unit assembly.

21. Remove gear unit from Holding Fixture and lay unit on its side. Install thrust washer on rear

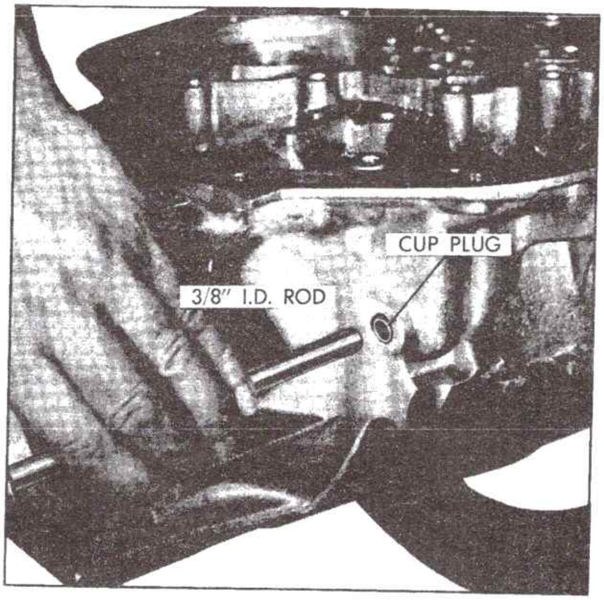


Fig. 7-91 Installing Cup Plug

face of output shaft with bent tabs in tab pockets. Retain thrust washer with petrolatum.

18. Major Transmission Components—Installation

a. Install Parking Pawl

NOTE: The first three steps can be omitted if the parts involved were not removed during disassembly.

1. Install parking pawl, tooth toward center of transmission, and install parking pawl shaft, Fig. 7-90.

2. Install parking pawl shaft retainer clip.

3. Install parking pawl shaft cup plug by driving into the transmission case, using a 3/8 inch diameter rod, until the parking pawl shaft bottoms on the case rib, Fig. 7-91.

4. Install parking pawl return spring with square end hooked on pawl.

5. Install parking pawl bracket with guides over parking pawl, Fig. 7-92. Install two attaching screws, tightening screws to 18 foot-pounds.

b. Install Rear Band and Complete Gear Unit Assembly

1. Inspect rear band for cracks or distortion and band ends for damage at anchor lugs and apply lug. Also inspect lining for cracks, flaking, burning and looseness.

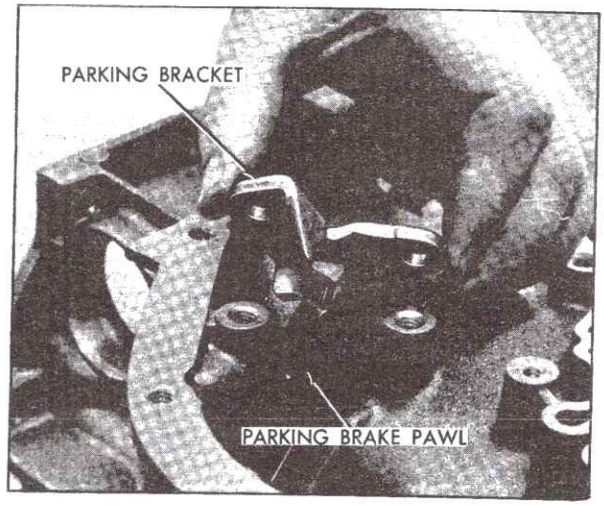


Fig. 7-92 Installing Parking Pawl Bracket

2. Install rear band assembly in transmission case so that band lugs index with anchor pins, Fig. 7-93.

3. Install previously selected rear unit selective washer into slots provided inside rear of transmission case. Retain washer with petrolatum.

NOTE: Proper washer size was determined at time of rear unit end play check (Note 16n).

4. Place transmission case in Holding Fixture in horizontal position. Do not over-tighten transmission holding fixture side pivot pin as this will cause binding when gear unit is installed.

5. Install proper diameter length of pipe over output shaft to be used as a handle and to prevent spline damage to case bushing when installing gear unit assembly.

CAUTION: Be careful not to drop or bump assembly in transmission case during installa-

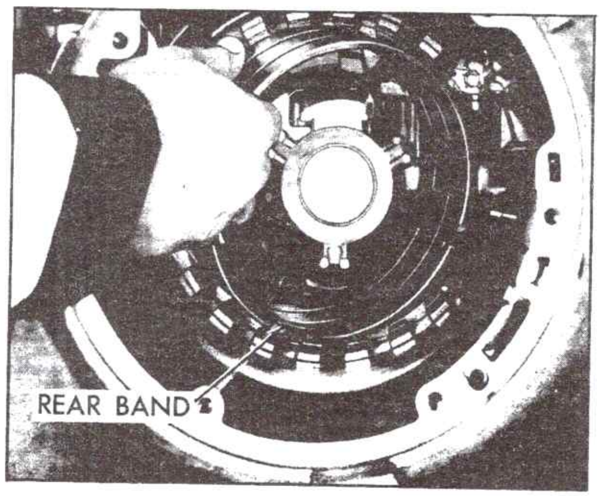


Fig. 7-93 Installing Rear Band Assembly

tion. This could result in damage to output shaft case bushing as well as to assembly itself.

6. Install gear unit with center support and reaction carrier, by lining up slots and carefully guiding complete assembly horizontally into transmission case, making certain the center support bolt hole is properly aligned with hole in case.

7. Position transmission vertically with front end of case facing upward. Remove tool, J-21365.

8. Lubricate center support to case snap ring with transmission fluid and install snap ring in transmission case with beveled side up, locating gap adjacent to front band anchor pin. Expand snap ring until center support is against shoulder of case.

9. Install a center support-to-case locating screw (small screw) into case against center support. Tighten screw to 5 foot-pounds.

10. Lubricate tapped hole in center support with transmission fluid and install center support-to-case support bolt through case into center support, Fig. 7-94. Tighten bolt to 23 foot-pounds.

11. Remove locating screw.

12. Before installing intermediate clutch plates, inspect plates for signs of burning, scoring, and wear.

13. Lubricate three steel and three composition intermediate clutch plates with transmission fluid and install clutch plates in transmission case, Fig. 7-95. Start with waved steel plate and alternate composition and steel plates.

14. Install intermediate clutch backing plate with machined surface against clutch plates.

15. Install backing plate to case snap ring with

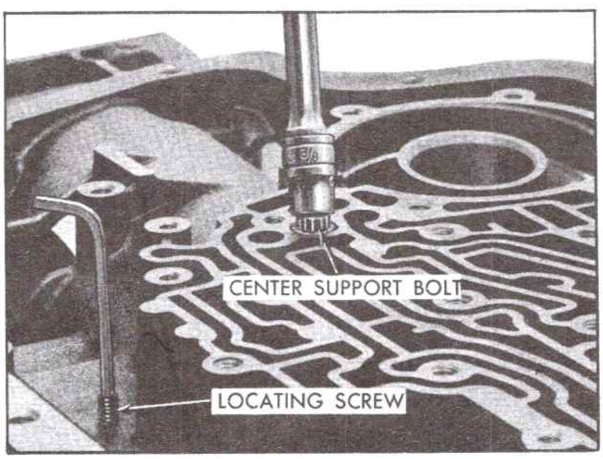


Fig. 7-94 Installing Center Support Bolt

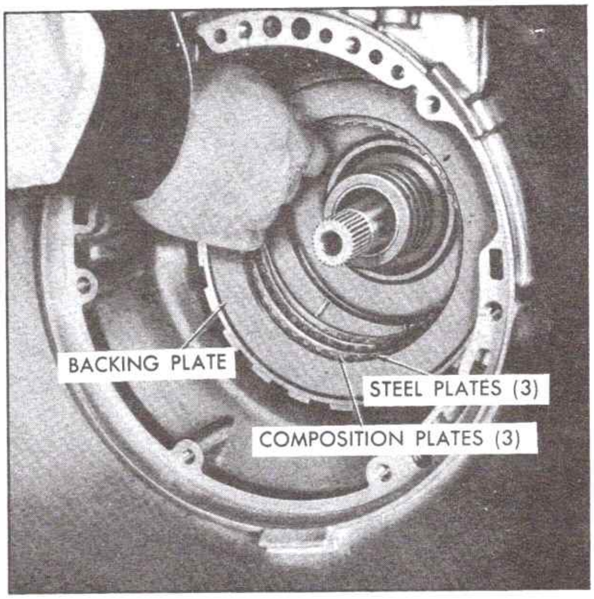


Fig. 7-95 Installing Intermediate Clutch Plates

snap ring gap on side of case opposite front band anchor pin.

16. Recheck rear unit end play as described in Note 16n.

c. Install Front Band and Remaining Clutch Assemblies

1. Inspect front band for cracks or distortion and band ends for damage at anchor lug and apply lug. Also inspect lining for cracks, flaking, burning, and looseness.

2. Install front band with band anchor hole over band anchor pin, and apply lug facing servo hole, Fig. 7-96.

3. Install direct clutch housing and intermediate sprag assembly on center support. Make certain

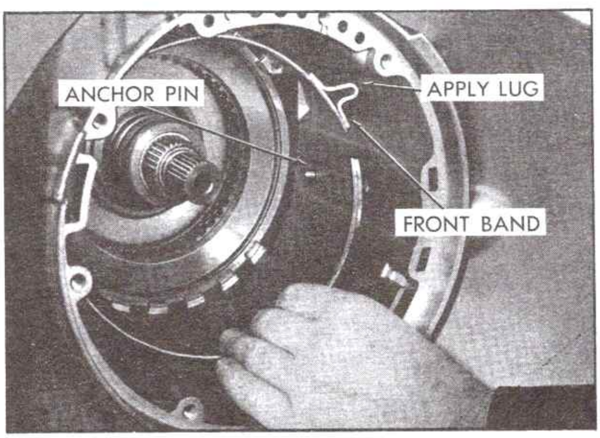


Fig. 7-96 Installing Front Band

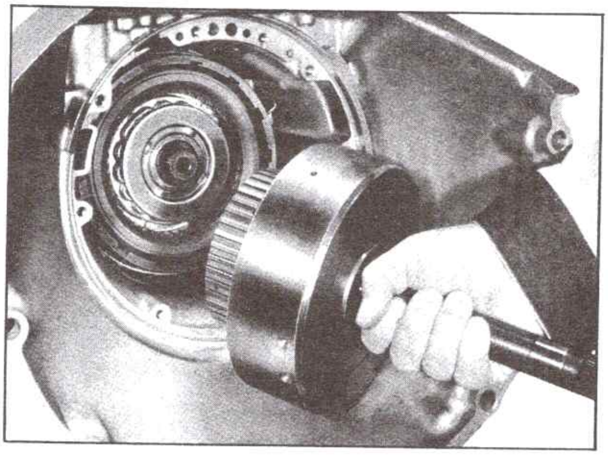


Fig. 7-97 Installing Forward Clutch Assembly

that clutch housing hub bottoms on sun gear shaft and splines on forward end of sun gear shaft are flush with splines in direct clutch housing.

NOTE: It will be necessary to rotate clutch housing to allow sprag outer race to index with intermediate clutch drive plates. Removal of direct clutch drive and driven plates may be helpful and applying air pressure through the center support screw to apply the intermediate clutch plates may facilitate assembly.

4. Install forward clutch hub to direct clutch housing thrust washer on forward clutch hub. Retain with petrolatum.

5. Position transmission horizontally in Holding Fixture and install forward clutch assembly and turbine shaft, Fig. 7-97. Make certain end of main shaft goes all the way into forward clutch hub. It will be necessary to rotate clutch housing to allow direct clutch driving hub to index with direct clutch drive plates. When forward clutch is seated, it will be approximately 1-1/4 inches from pump mounting face in case.

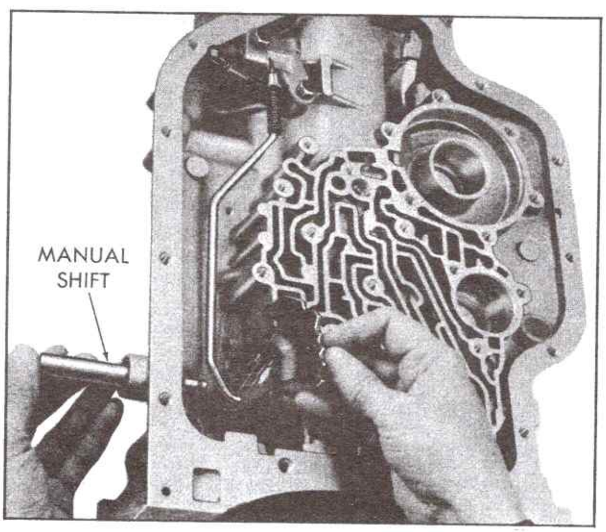


Fig. 7-98 Installing Manual Shaft

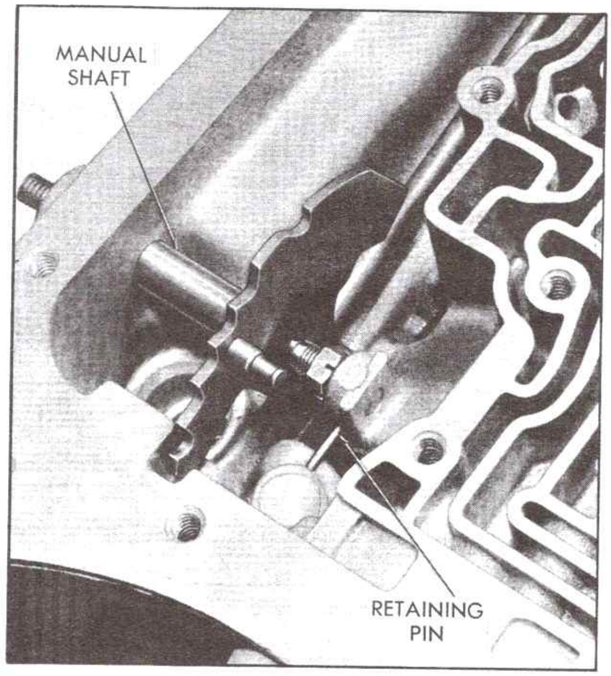


Fig. 7-99 Installing Manual Shaft Retaining Pin

NOTE: Missing internal splines in forward clutch hub are lubrication passages and do not have to be indexed with any particular spline on main shaft.

d. Install Parking Linkage, Detent Lever, and Manual Shaft

1. If removed, install a new manual shaft seal into the case using a 3/4 inch diameter rod to seat the seal.

2. Insert actuator rod into manual detent lever from side opposite pin.

3. Install actuator rod plunger under parking bracket and over parking pawl.

4. Install manual shaft assembly into case and through detent lever, Fig. 7-98.

5. Install locknut on manual shaft. Tighten nut to 18 foot-pounds.

6. Install manual yoke on manual shaft. Tighten nut to 18 foot-pounds.

7. Install retaining pin in case, indexing it with groove in manual shaft, Fig. 7-99.

NOTE: If procedure is being performed with transmission in car, install and straighten bent pin.

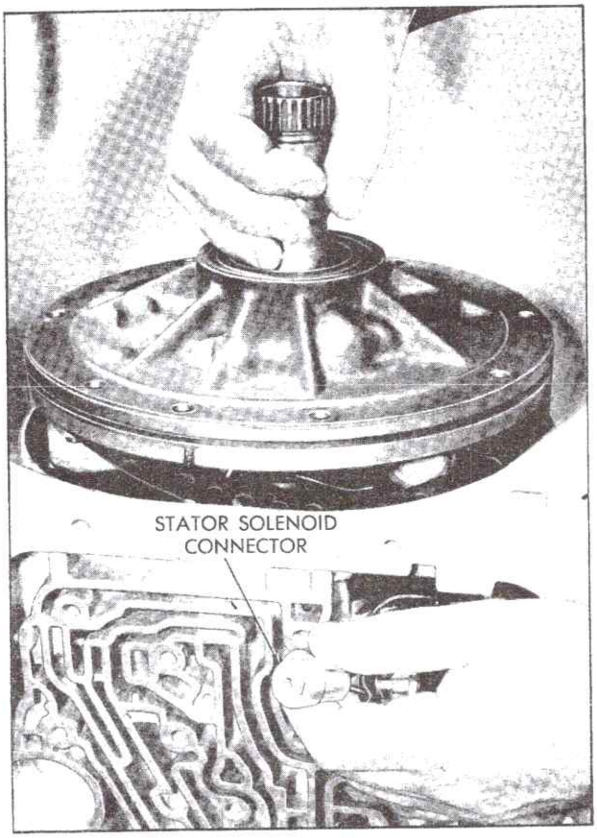


Fig. 7-100 Installing Pump Assembly

e. Install Oil Pump

1. Lubricate turbine shaft journals with transmission fluid and lubricate hook-type oil rings on pump delivery sleeve with petrolatum.

2. Install Slide Hammer Bolts, J-6125-1 and Adapters, J-6125-2, through two opposite unthreaded holes in pump assembly to serve as guide pins when installing pump.

3. Position pump assembly in transmission case and thread Slide Hammer assemblies into their corresponding threaded holes in transmission case.

4. Guide stator wire on AA transmissions through case hole at pressure regulator, Fig. 7-100.

5. Install pump assembly in transmission case, Fig. 7-100. Do not remove slide hammer bolts until last two pump attaching screws are installed.

6. Using seven new rubber-coated washers on pump attaching screws, install all but one attaching screw at either 5 o'clock or 10 o'clock position so that front unit end play can be rechecked. Tighten screws to 18 foot-pounds.

NOTE: If turbine shaft cannot be rotated as pump is being pulled into place, the forward or direct clutch housings have not been installed properly to index with all the clutch plates. This condition must be corrected before pump is pulled fully into place.

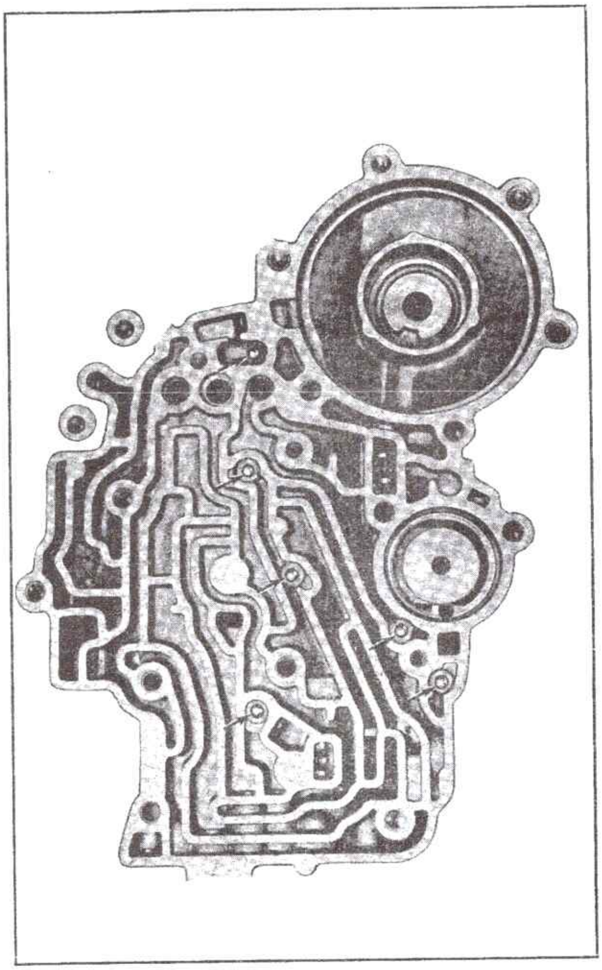


Fig. 7-101 Location of Check Balls

7. Recheck front unit end play as described in Note 16j.

8. Install remaining pump attaching screw using new O-ring. Tighten screw to 18 foot-pounds.

9. If necessary, install new front seal using Pump Oil Seal Installer, J-21359.

f. Install Extension Housing

1. Install new gasket on extension housing, retaining with petrolatum.

2. Check O-ring on output shaft on AA and AC transmissions, for any nicks or flattening and replace O-ring if either condition exists.

3. Secure extension housing to case with six

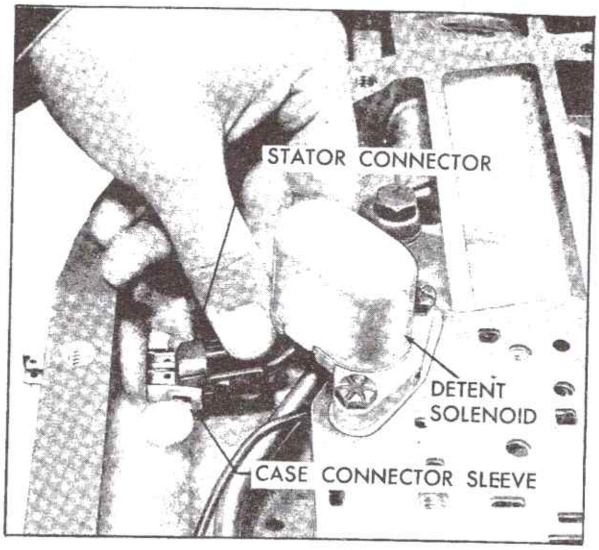


Fig. 7-102 Installing Stator Connector

attaching screws. Tighten screws to 23 foot-pounds.

4. If necessary, install a new extension housing oil seal using Oil Seal Installer, J-21464. Apply non-hardening sealer to outside of seal before installation.

g. Install Check Balls, Front Servo Assembly, Control Valve Spacer and Gaskets, Detent Solenoid, and Solenoid Connector

1. Install front servo spring and retainer into transmission case.

2. Install flat washer on front servo pin on end opposite taper, and install pin into case so that tapered end contacts band.

3. Install seal ring on servo piston, if removed, and install on apply pin with identification numbers on shoulder positioned toward bottom pan.

4. Check freeness of piston by stroking it in bore.

5. Install six check balls into ball seat pockets in transmission case, Fig. 7-101.

NOTE: If operation is being performed on car, install check balls into ball seat pockets on spacer plate.

6. Install control valve spacer to case gasket (gasket with extension for detent solenoid).

7. Install control valve spacer.

8. Install detent solenoid gasket.

9. Install detent solenoid assembly with connector facing outer edge of case. Do not tighten screws at this time.

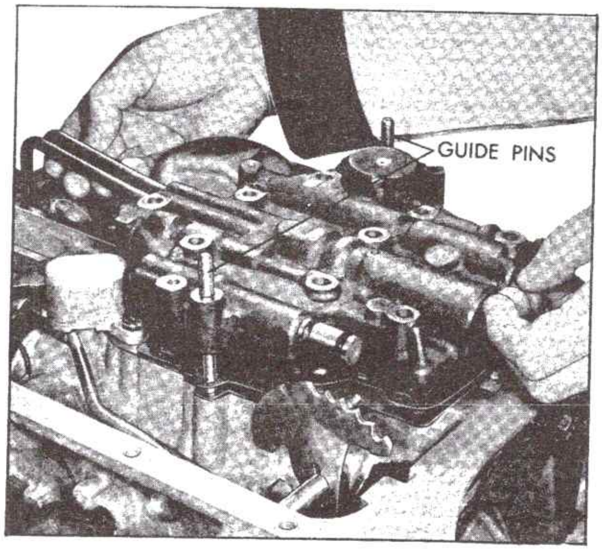


Fig. 7-103 Installing Control Valve Assembly

10. Install control valve to spacer gasket (gasket with slot).

11. Install new O-ring on solenoid connector.

12. Install connector with lock tabs pointing into case. Position locator tab in notch on side of case.

13. Connect solenoid, and on AA transmissions, stator lead, to connector terminals, Fig. 7-102.

h. Install Rear Servo Assembly

1. Lubricate inner and outer rear servo bores in transmission case with transmission fluid and install rear accumulator spring in servo inner bore.

NOTE: Before installing rear servo assembly, make certain that rear band apply lug is aligned with servo pin bore in transmission case. Otherwise servo pin will not apply band.

2. Position rear servo assembly in transmission.

3. Press down on rear servo assembly, making certain O-ring is properly seated in case bore, and install rear servo cover and new gasket. Install six attaching screws, tightening screws to 18 foot-pounds.

i. Install Control Valve Assembly

1. Install governor pipes on control valve assembly. Governor pipes are interchangeable.

2. Using two control valve assembly attaching screws with heads cut off as guide pins, Fig. 7-103, install control valve assembly and governor pipes on transmission. Make certain gaskets and spacer do not become mispositioned.

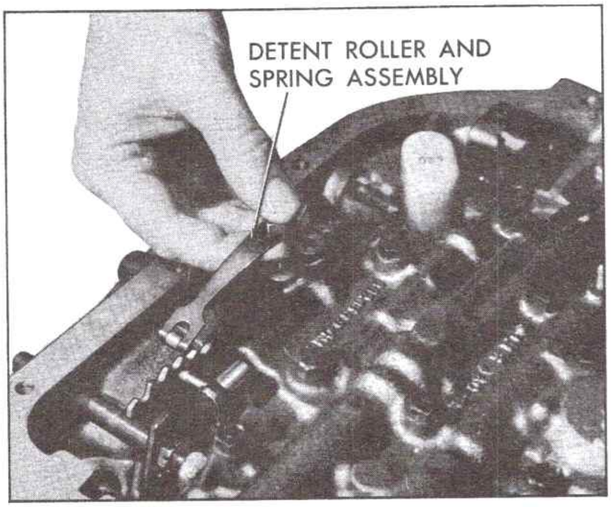


Fig. 7-104 Installing Detent Spring and Roller Assembly

NOTE: Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipes to make certain they are properly seated in case holes.

3. Remove guide pins and install control valve assembly attaching screws, washers, and wire clip, eliminating detent spring and roller assembly attaching screw. Torque bolts to 8 foot-pounds.

4. On AA transmissions, attach stator wire to clip, routing wire around bolt heads.

5. Install detent spring and roller assembly, Fig. 7-104, and attaching screw. Tighten screw to 8 foot-pounds.

6. Tighten detent solenoid attaching screws to 12 foot-pounds.

j. Install Modulator Valve and Vacuum Modulator

1. Install modulator valve into case with stem end out.

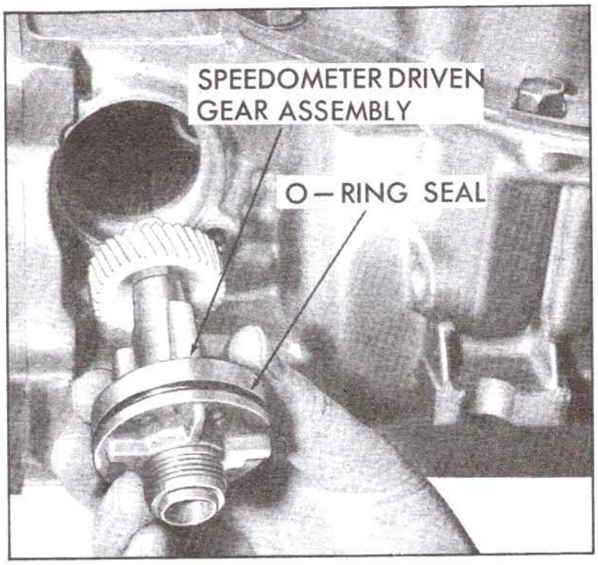


Fig. 7-105 Installing Speedometer Driven Gear

2. Install new O-ring on vacuum modulator.

3. Install vacuum modulator into case with vacuum hose pipe facing rear of car and angled 5° toward top of case.

4. Install modulator retainer with curved side of tangs inboard and install attaching screw. Tighten screw to 18 foot-pounds.

k. Install Governor Assembly

1. Use a new gasket and install governor assembly into transmission case.

l. Install Speedometer Driven Gear Assembly

Speedometer driven gears are provided in three different tooth sizes as well as two different sleeve sizes. Driven gear must be installed in sleeve having tooth range corresponding to number of teeth in gear. Refer to following chart to select proper gear:

Transmission Letter Code	Rear Axle Ratio	Pinion Gear Teeth	Worm Gear Teeth	Sleeve Tooth Range	Color of Gear	Tire Size
AA	2.94:1	38	18	36-39	Blue	9.00
	3.21:1	41	18	40-43	Yellow	9.00
AB	3.36:1	41	18	40-43	Yellow	8.90
AC	3.21:1	43	19	40-43	Purple	8.20

1. Check number of teeth stamped on nylon gear. Locate corresponding tooth range on outside face of sleeve and install sleeve and driven gear with tooth range numbers on outside face of sleeve toward bottom of transmission, Fig. 7-105.

2. Install speedometer driven gear retainer with tangs in sleeve positioning bosses, and install attaching screw. Tighten screw to 18 foot-pounds.

m. Install Intake Pipe and Strainer Assembly and Bottom Pan

1. Install new intake pipe O-ring into pipe bore in transmission case and install intake pipe and strainer assembly.

2. Install new gasket on bottom pan and install bottom pan.

3. Install thirteen bottom pan attaching screws. Tighten screws to 12 foot-pounds.

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot Pounds
280M	Solenoid to Case Screw.	1/4-20	0
300M	Strut to Starter Screw	5/16-18	23
260M	Control Valve Assembly to Case Screw	1/4-20	8
260M	Strut to Crankcase Screw	3/8-16	23
260M	Control Valve Assembly to Case Screw	5/16-18	8
280M	Strut to Transmission Lower Cover Screw . . .	3/8-16	30
Special	Line Pressure Plug	1/8 Pipe	10
280M	Lower Cover to Transmission Screw	3/8-16	28
280M	Pump Body to Cover Screw	5/16-18	18
280M	Lower Cover to Crankcase	3/8-16	28
280M	Pump Assembly to Case Screw	5/16-18	18
280M	Rear Servo Cover to Case Screw	5/16-18	18
260M	Governor Cover to Case Screw	5/16-18	18
280M	Parking Pawl Bracket to Case Screw	5/16-18	18
260M	Vacuum Modulator Retainer to Case Screw . . .	5/16-18	18
260M	Speedometer Driven Gear Retainer to Case Screw	5/16-18	18
1010-1020	Bottom Pan to Case Screw	5/16-18	12
260M	Extension Housing to Case Screw	3/8-16	23
286M	Manual Shaft to Detent Lever Nut.	3/8-24	18
286M	Manual Yoke to Manual Shaft Nut	3/8-24	18
300M	Case to Center Support - Support Bolt	3/8-16	23
280M	Flex-Plate to Converter Bolt	3/8-16	28
280M	Transmission Case to Engine Screw	3/8-16	30
Steel	Oil Cooler Pipe Connector Nut at Case	5/8-18	28
Brass	Cooler Pipe Connector at Case	1/4-18	28
280M	Filler Pipe Bracket to Exhaust Manifold Screw .	7/16-14	60
280M	Engine Rear Mount Screw	7/16-14	55
280M	Engine Rear Support Bracket to Frame Bolt . .	3/8-24	30
286M	Engine Front Cushion to Frame Nut	1/2-20	90
Steel	Transmission Vacuum Control Pipe to Manifold Vacuum Fitting Nut	7/16-24	14

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.

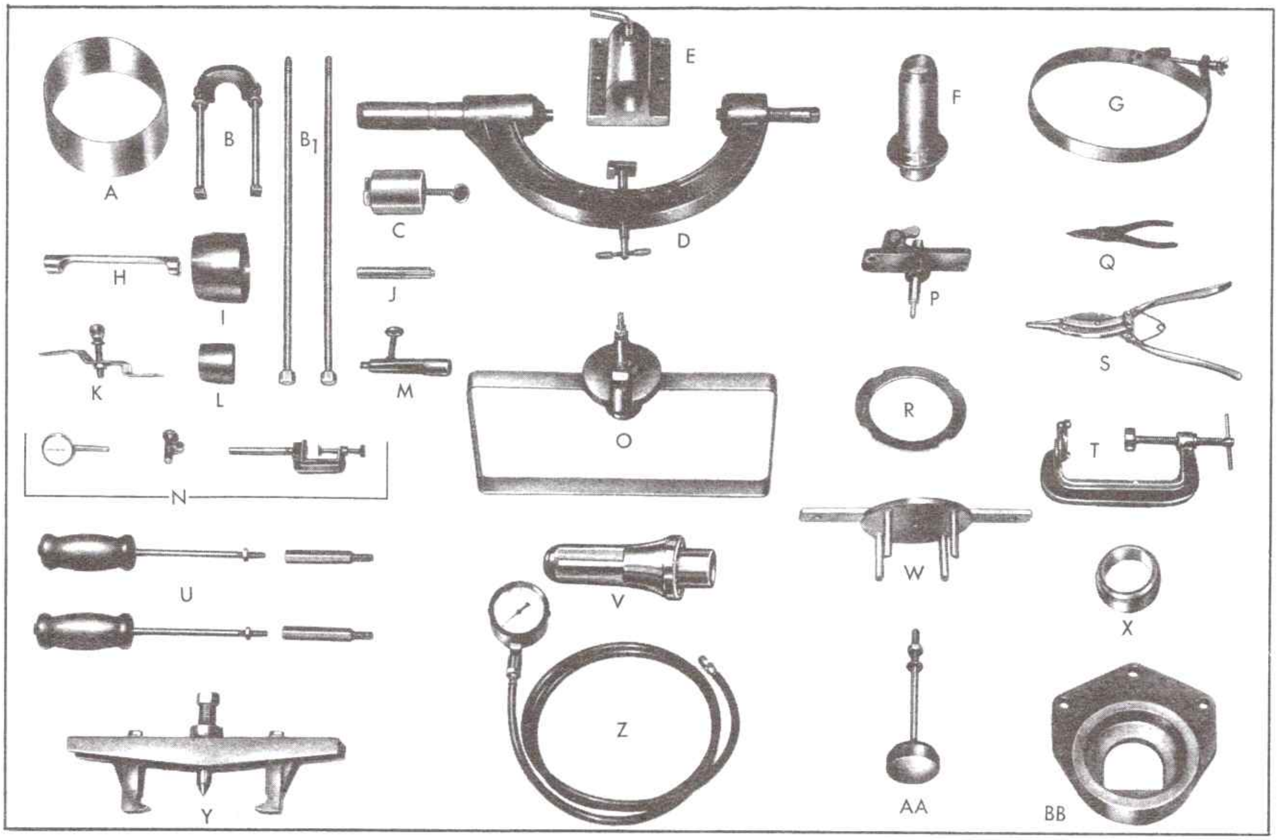


Fig. 7-106 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21409	Forward and Direct Clutch Piston Installer	N	J-8001	Dial Indicator Set
B	J-21427	Speedometer Drive Gear Remover	O	J-21369	Converter Leak Test Fixture
B1	J-21797	Speedometer Drive Gear Remover Bolts	P	J-21370	Band Apply Pin Selector Gage (Use J-21370-5 Pin)
C	J-21795	Gear Assembly Remover and Installer Adapter	Q	J-5403	Snap Ring Pliers (#21)
D	J-8763	Transmission Holding Fixture	R	J-21664	Clutch Spring Compressor Adapter
E	J-3289-01	Holding Fixture Base	S	J-8059	Snap Ring Pliers
F	J-21359	Pump Oil Seal Installer	T	J-21885	Control Valve Accumulator Piston Installer
G	J-21368	Pump Body and Cover Alignment Band	U	J-6125	Slide Hammer Assemblies
H	J-21477	Oil Cooler Pipe Wrench	V	J-21464	Extension Housing Oil Seal Installer
I	J-21363	Intermediate Clutch Inner Seal Protector	W	J-4670	Clutch Spring Compressor
J	J-21360	Pump Check Valve Seat Installer	X	J-21364	Rear Unit Holding Fixture Adapter
K	J-21366	Converter Holding Clamp	Y	J-8433	Pulley Puller
L	J-21362	Forward and Direct Clutch Inner Seal Protector	Z	J-5907	0-300 PSI Pressure Gage
M	J-21361	Pump Check Valve Seat Remover	AA	J-6129	Rear Clutch Spring Compressor
			BB	J-6116	Rear Unit Holding Fixture

GENERAL DESCRIPTION

NOTE: The following information pertains only to the Fleetwood Eldorado.

The Turbo Hydra-matic transmission, Fig. 7-107, used on the Fleetwood Eldorado is a fully automatic transmission used for front wheel drive applications.

The Turbo Hydra-matic transmission consists primarily of a three-element hydraulic torque converter, a dual sprocket and link assembly and a compound planetary gear set. Three multiple-disc clutches, a sprag unit, a roller clutch unit, and two bands provide the friction elements required to obtain the desired functions of the compound planetary gear set.

The torque converter, the dual sprocket and link, the clutches, the sprag and roller clutch, couple the engine to the planetary gears, providing three forward speeds and reverse. The torque converter, when required, will supplement the gears by multiplying engine torque.

The torque converter is of welded construction and is serviced as an assembly. The unit is made up of two vaned sections, or halves, that face each other in an oil filled housing. The pump half of the converter is connected to the engine and the turbine half is, in effect, connected to the transmission.

The torque converter couples the engine to the planetary gear set through the use of a drive sprocket, a link assembly, and a driven sprocket. Clockwise engine torque turns the drive sprocket clockwise, which, in turn, drives the driven sprocket in a clockwise direction. This in effect is a reverse in the direction of engine torque due to the side mounting of the gear unit.

When the engine makes the converter pump revolve, it sends oil against the turbine, making it revolve also. The oil then returns in a circular flow back to the converter pump, continuing this flow as long as the engine is running.

The converter also has a smaller vaned section, called a stator, that funnels the oil back to the converter pump through smaller openings, at increased speed. The speeded up oil directs additional force to the engine-driven converter pump, thereby multiplying engine torque.

The stator assembly on all AJ transmissions is a variable pitch stator. The stator blades are operated at either of two positions; maximum or high angle, and minimum or low angle.

Maximum or high stator angle means greater redirection of the oil and increased engine speed and torque multiplication for maximum performance. At engine idle it reduces the converter's efficiency, reducing "creep." Minimum or low angle results in a more efficient converter for cruising operation.

A hydraulic system pressurized by an internal-external type gear pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections to the transmission are:

Manual Linkage - To select the desired operating range.

Engine Vacuum - To operate a vacuum modulator unit.

12 Volt Electrical Signals - To operate an electrical detent solenoid, and the stator solenoid used on AJ transmissions.

Gear or Torque ratios of the transmission are as follows:

First	= 2.48:1 gear ratio
Second	= 1.48:1 gear ratio
Third	= 1.0:1 gear ratio
Reverse	= 2.08:1 gear ratio

Each gear ratio can be multiplied by as much as 2, depending upon the slip speed of the converter pump and turbine.

A vacuum modulator is used to sense engine torque input to the transmission automatically. The vacuum modulator transmits this signal to the pressure regulator, which controls line pressure, so that all torque requirements of the transmission are met and proper shift spacing is obtained at all throttle openings.

The detent solenoid is activated by a switch at the carburetor. When the throttle is opened sufficiently to close this switch, the solenoid in the transmission is activated, causing a downshift at speeds below 70 miles per hour. At lower speeds, downshifts will occur at lesser throttle openings without use of the switch.

On all cars equipped with the AJ transmission, the stator solenoid is activated by a signal from the switch at the carburetor.

The switch at the carburetor changes the stator blades from low to high angle above 40° throttle opening and below 6° throttle opening.

The oil cooler is located in the right hand tank of the radiator. The transmission is cooled by directing oil from the converter to the radiator. Oil returning from the radiator feeds the transmission lubrication system.

The oil system incorporates an intake pipe and strainer assembly. An internal by-pass in the strainer permits increased oil flow during cold operation when the oil is heavier. The intake pipe and strainer assembly should be replaced after the first 24,000 miles or two years, whichever occurs first, or in any case where a major transmission failure has occurred. In the event of a major transmission failure, the converter assembly should also be replaced and the oil cooler and lines should be flushed.

The transmission quadrant has six selector positions, that enable the driver to control the operation of the transmission under various driving conditions. The six selector positions appear on the quadrant in the following sequence, from left to right; P-park, R-reverse, N-neutral, DRIVE left, DRIVE right (intermediate) and L-lo. The engine can be started in the Park and Neutral positions only.

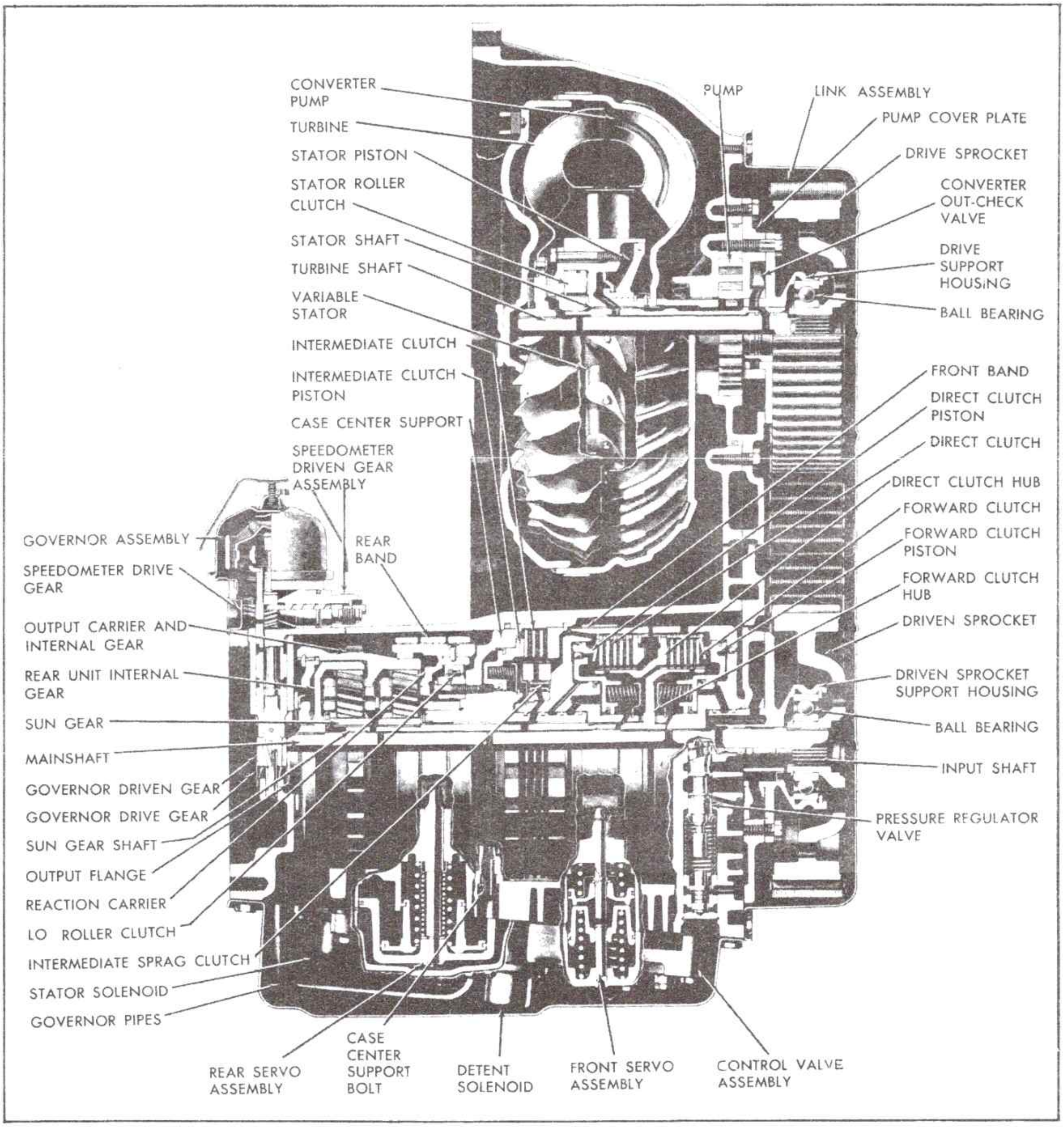


Fig. 7-107 Turbo-Hydra-Matic Transmission Cutaway

P - Park position positively locks the output shaft to the transmission case by means of a locking pawl and prevents the vehicle from rolling either forward or backward. The engine may be started in Park position.

R - Reverse enables the vehicle to be operated in a reverse direction.

N - Neutral position enables the engine to be started and run without driving the vehicle.

Drive (left) - Drive (left) is used for all normal driving conditions and maximum economy.

Drive (left) has three gear ratios from starting to direct drive. Downshifts are available for safe passing, by depressing the accelerator pedal.

Drive (right) - Drive (right) adds performance for congested traffic or hilly terrain. This range has the same starting ratio as Drive (left), but prevents the transmission from shifting above second speed to retain acceleration when extra performance is desired. Engine braking is provided in this range.

L - Lo range permits operation at a lower gear ratio, and should be used where maximum torque multiplication is desired, such as in pulling a heavy load or descending a steep grade. When selector lever is moved from Drive to Lo range at normal highway speeds, the transmission will shift to second gear and remain in second gear until vehicle speed is reduced to the normal 2-1 downshift speed. The transmission will then shift to first gear and remain in first gear regardless of vehicle or engine speed, until selector lever is moved back into either of the Drive positions.

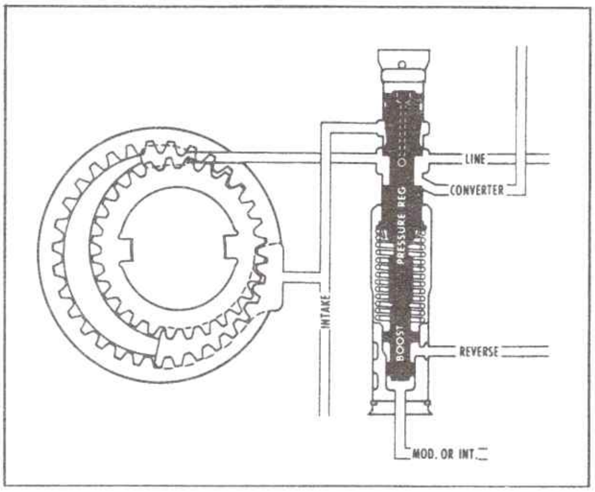


Fig. 7-108 Pressure Control

Pressure Control

The transmission is controlled automatically by a hydraulic system, Fig. 7-108. Hydraulic pressure is supplied by the transmission oil pump, which is engine driven. Main line pressure is controlled by a pressure regulator valve train located in the transmission case and by the vacuum modulator which is connected to engine vacuum. The pressure regulator controls line pressure automatically, in response to a pressure signal from a modulator valve. In such a way that the torque requirements of the transmission clutches are met and proper shift spacing is obtained at all throttle openings.

HYDRAULIC SYSTEM DESCRIPTION

To control line pressure properly, a modulator pressure is used which varies in the same manner as torque input to the transmission. Since the torque input to the clutches is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum, which is an indicator of engine torque and carburetor opening. It will decrease with an increase in vehicle speed to compensate for the changing converter torque ratio, by virtue of the governor pressure influence.

Vacuum Modulator Assembly

The engine vacuum signal is received by the vacuum modulator, Fig. 7-109, which consists of an evacuated metal bellows, a diaphragm and a spring. These are so arranged that the bellows and spring apply a force that acts on the modulator valve so that it increases modulator pressure. Engine vacuum and a spring opposite the bellows and spring to control modulator pressure.

To reduce the effect of altitude on shift points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

Governor Assembly

The vehicle speed signal to the transmission is supplied by the governor, which is driven by the output flange. The governor consists of flyweights and a regulator valve. Centrifugal force of the flyweights is imposed on the regulator valve, causing it to regulate a pressure signal that increases with speed.

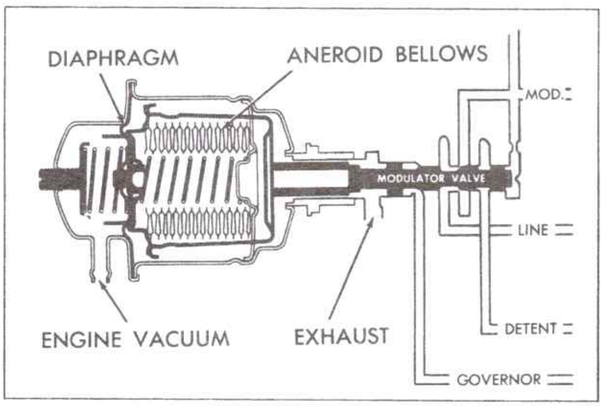


Fig. 7-109 Vacuum Modulator Assembly

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as vehicle speed increases.

Functions of Valves and Hydraulic Control Units

The valves in the Turbo Hydra-matic transmission used on the Cadillac Eldorado function and are located identically to their corresponding

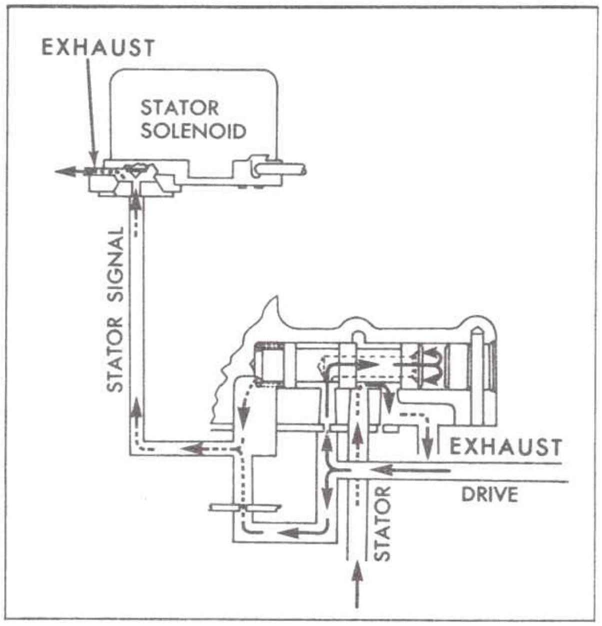


Fig. 7-110 Stator Valve High Angle

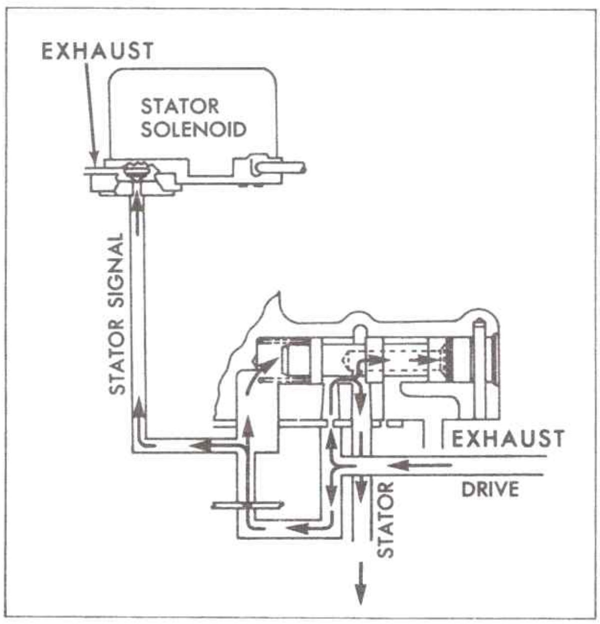


Fig. 7-111 Stator Valve Low Angle

valves in the regular Turbo Hydra-matic transmission with the following exceptions:

1. The pressure regulator valve is located in the transmission case. The valve functions as a regulator of line pressure. The bottom pan must be removed to service this valve located in the right rear corner of the case valve body mounting pad.

2. The stator valve is located in the control valve assembly. The stator solenoid is located just left of front center on the case valve body mounting pad.

When the stator solenoid is activated, stator signal oil is exhausted from the stator feed line. This allows drive oil to overcome a spring pressure and move the valve. This in turn, allows stator signal oil to exhaust from the stator piston, which then moves to high angle, Fig. 7-110.

When the stator solenoid is NOT activated, drive oil and spring pressure keep the stator valve closed and the stator piston in its normal low angle position, Fig. 7-111.

3. The modulator valve has a case to valve bushing in which it operates.

4. The governor is mounted with a clip, an external stamped housing, and a square cut O-ring seal.

PARK OR NEUTRAL—ENGINE RUNNING POWER FLOW

Forward Clutch - Released

Roller Clutch - Ineffective

Direct Clutch - Released

Front Band - Released

Rear Band - Released

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

In Neutral or Park no bands or clutches are applied, therefore no power is transmitted.

OIL FLOW (Fig. 7-112)

Whenever the engine is running at idle with the selector lever in "P" or "N", oil from the pump is directed to the:

1. Converter
   a. Oil Cooler
   b. Lubrication System
2. Vacuum Modulator Valve
   a. Pressure Regulator Boost Valve
   b. 1-2 Accumulator and Primary Valves
   c. Detent Valve
   d. 3-2 Valve
   e. 2-3 Shift Valve Train
   f. 1-2 Shift Valve Train
3. Manual Valve
4. Detent Solenoid
5. Detent Valve
6. Front Servo Piston (Neutral only)

Cooling and Lubrication

Oil flows from the pump to the pressure regulator valve which regulates pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the converter feed passage to fill the converter. Oil from the converter is directed to the transmission cooler. Oil from the cooler is directed to the transmission lubrication system.

Line pressure acts on the:

1. Manual Valve
2. Detent Valve
3. Detent Solenoid
4. Modulator Valve

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1-2 accumulator and primary valves, and passes through the detent valve and 3-2 valve to the 1-2 and 2-3 valve trains.

Summary

The converter is filled. All clutches and bands are released. The transmission is in Neutral.

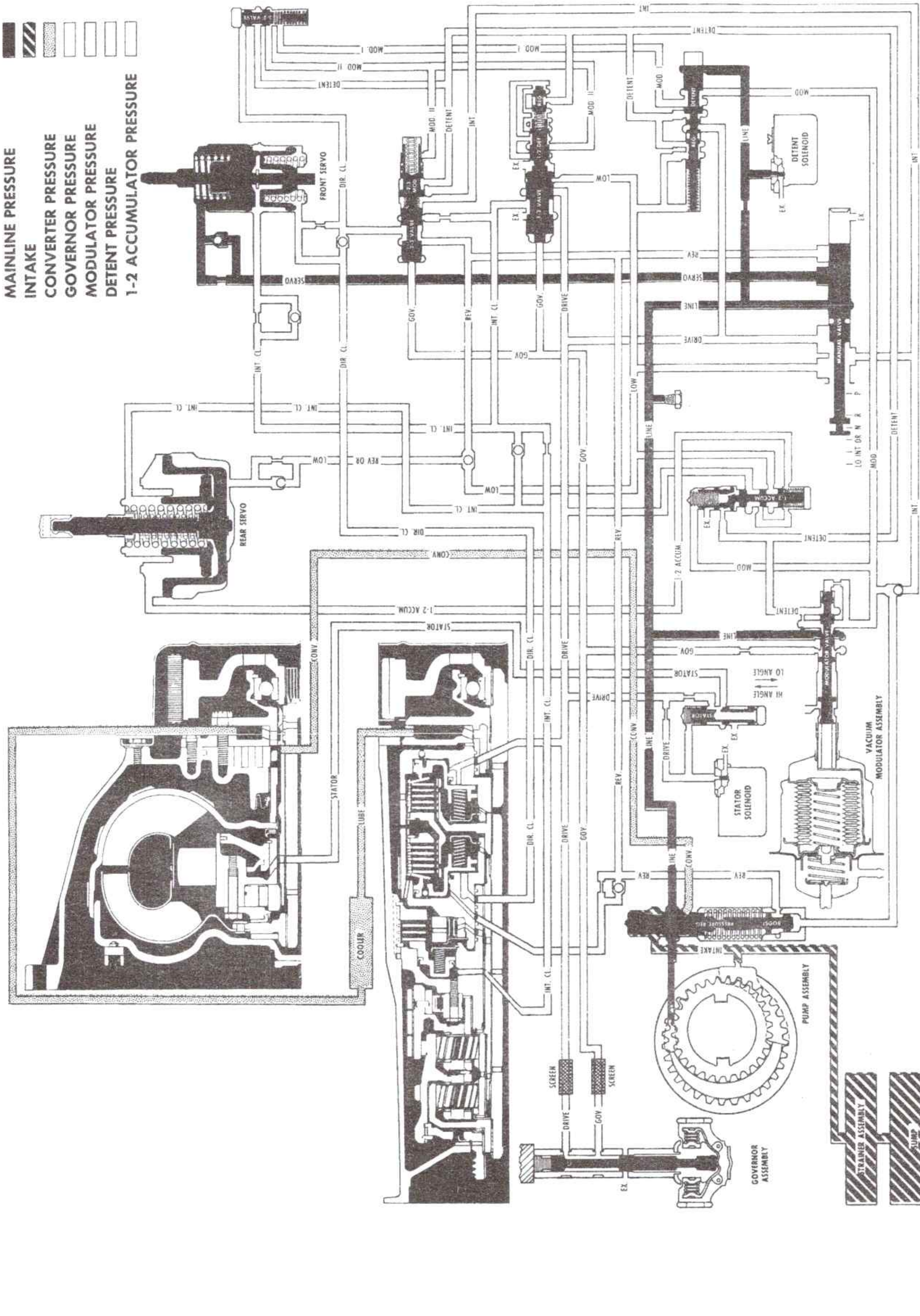


Fig. 7-112 Neutral - Engine Running

1967 425

DRIVE LEFT AND RIGHT—FIRST SPEED POWER FLOW (Fig. 7-113)

Forward Clutch - Applied

Roller Clutch - Effective

Direct Clutch - Released

Front Band - Released

Rear Band - Released

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

With the selector lever in either Drive Range, the forward clutch is applied. This delivers turbine torque to the drive sprocket, through the link assembly to the driven sprocket and mainshaft and turns the rear internal gear in a counterclockwise direction. (Converter torque ratio = approximately 2:1 at stall.)

Counterclockwise motion of the rear internal gear causes the rear pinions to turn counterclockwise to drive the sun gear clockwise. In turn, the sun gear drives the front pinions counterclockwise, thus turning the front internal gear, output carrier, and output flange counterclockwise in a reduction ratio of approximately 2.48:1. Reaction of the front pinions against the front internal gear is taken by reaction carrier and roller clutch assembly to the transmission case. (Approximate stall ratio - 5:1).

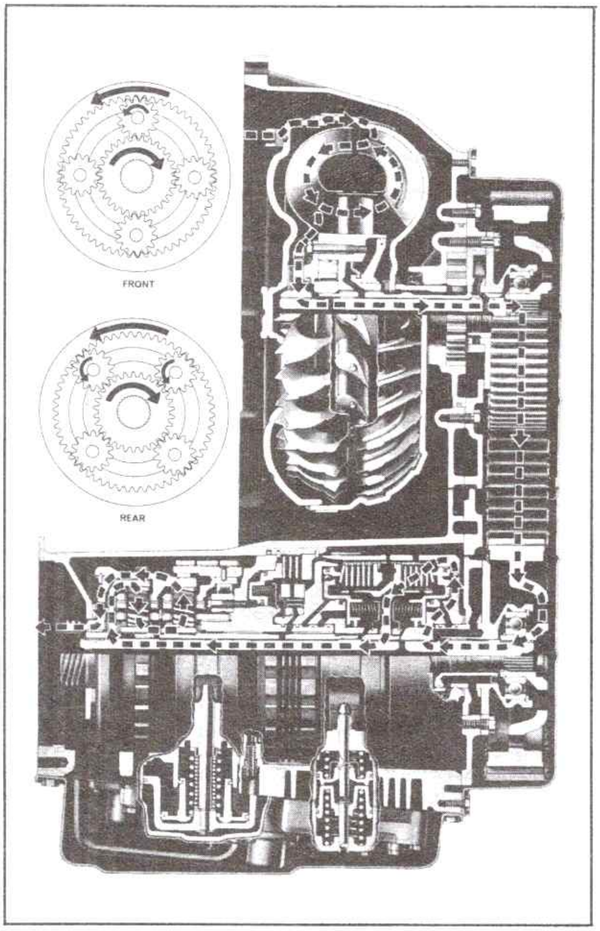


Fig. 7-113 Drive Range - First Gear

OIL FLOW (Fig. 7-114)

When the selector lever is moved to either Drive position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the:

1. Forward Clutch
2. Stator Solenoid and Stator Valve
3. 1-2 Shift Valve
4. Governor Assembly
5. 1-2 Accumulator Valve
6. Detent Regulator Valve

Basic Control

Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to insure a smooth shift into Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure increases with vehicle speed and acts against the ends of the 1-2 and 2-3 shift valves and an area on the modulator valve.

Drive oil is also regulated to another variable pressure at the 1-2 accumulator valve. This pressure is controlled by modulator oil and is directed to the rear accumulator piston. In addition, to maintain the lower pressure in the 1-2 accumulator passage, the 1-2 accumulator valve intermittently uncovers the lo oil passage and oil is exhausted at the manual valve.

Summary

The converter is filled and the stator blades are at either high or low angle, depending upon throttle position. The forward clutch is applied. The transmission is in first gear.

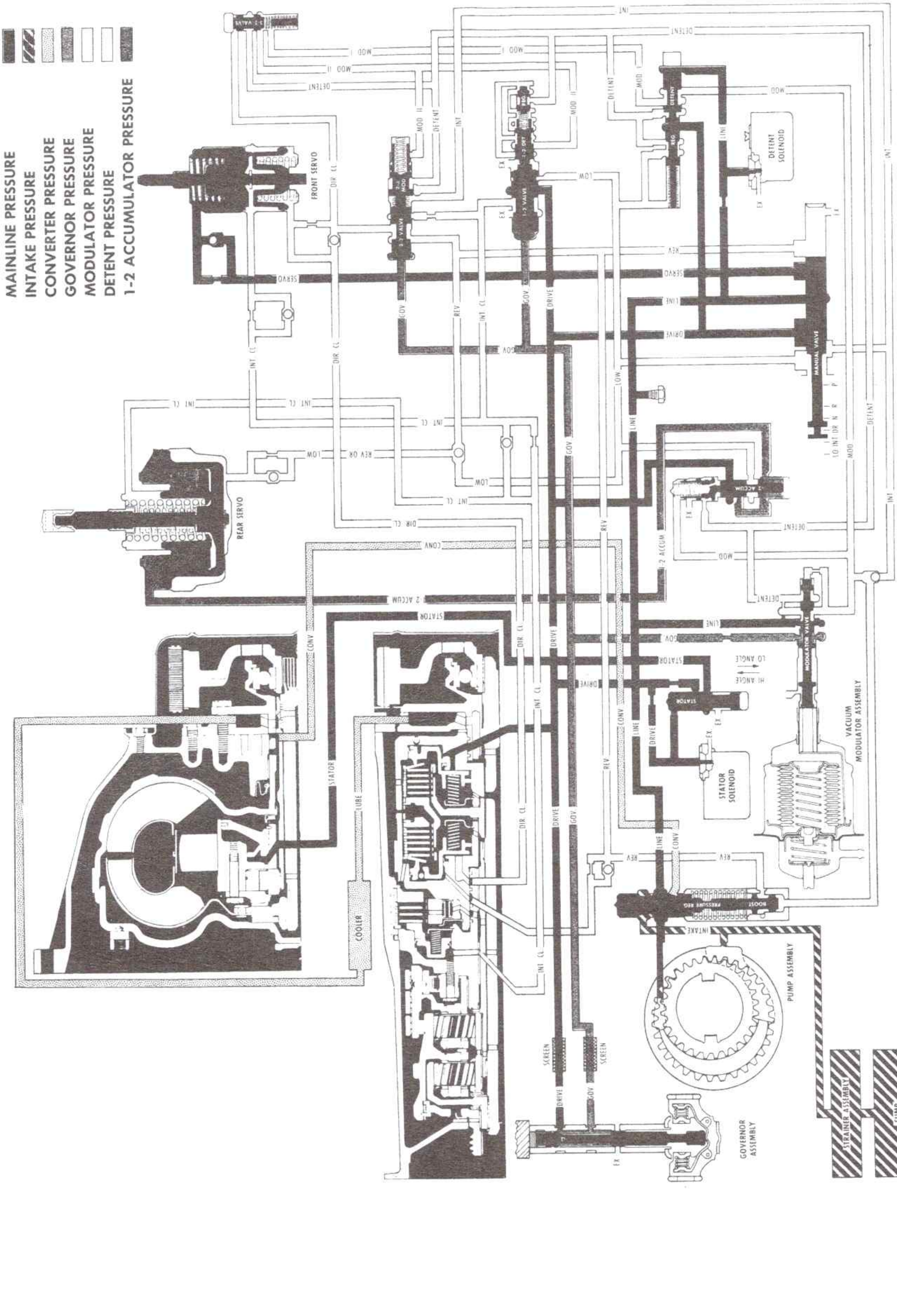


Fig. 7-114 Drive Range - First Gear

DRIVE (LEFT)—SECOND SPEED POWER FLOW (Fig. 7-115)

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against clockwise rotation. Turbine torque through the forward clutch is now applied through the drive sprocket, link assembly and driven sprocket to the mainshaft to the rear internal gear in a counterclockwise direction. Counterclockwise rotation of the rear internal gear turns the rear pinions counterclockwise against the stationary sun gear. This causes the output carrier and output flange to turn counterclockwise in a reduction ratio of approximately 1.48:1.

NOTE: Further reduction is possible, at low speeds, due to the torque multiplication provided by the converter.

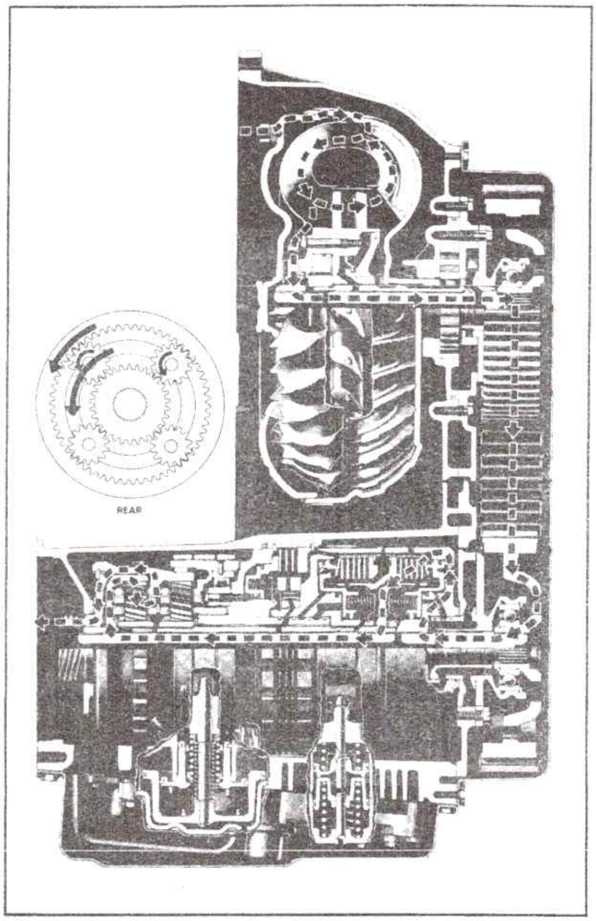


Fig. 7-115 Drive (Left) - Second Gear

OIL FLOW (Fig. 7-116)

As both vehicle speed and governor pressure increase, the force of governor oil acting on the 1-2 shift valve will overcome the force of regulated modulator oil pressure and the 1-2 valve spring. This allows the 1-2 shift valve to open, permitting drive oil to enter the intermediate clutch passage.

Intermediate clutch oil from the 1-2 shift valve is directed to the:

1. Intermediate Clutch
2. Rear Servo Accumulator
3. Front Servo Accumulator
4. 2-3 Shift Valve

Basic Control

Intermediate clutch oil from the 1-2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1-2 accumulator oil and accumulator spring to maintain controlled pressure in the clutch during a 1-2 shift for a smooth clutch apply. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to a land of the 2-3 shift valve.

Summary

The forward and intermediate clutches are applied. The transmission is in second speed.

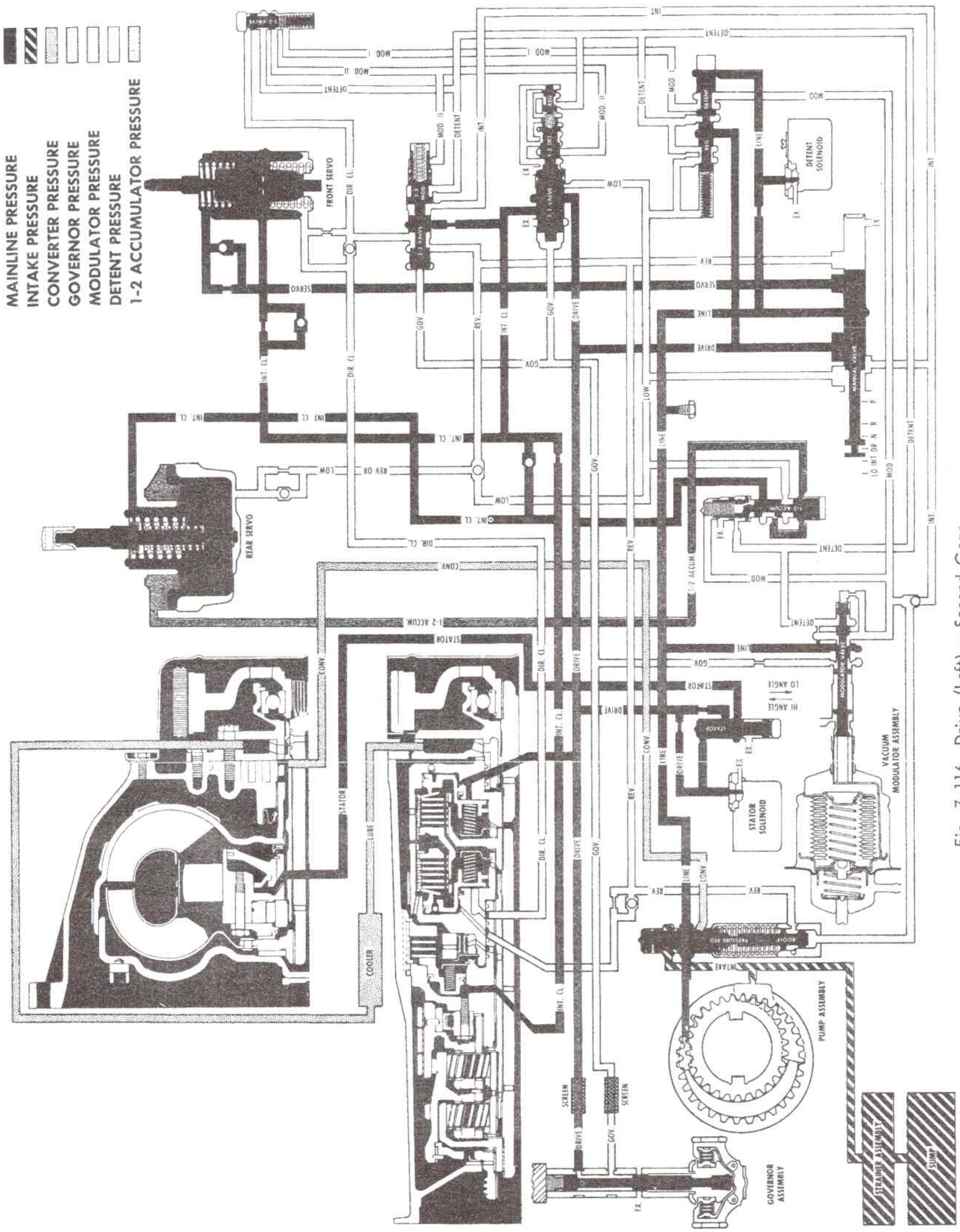


Fig. 7-116 Drive (Left) - Second Gear

DRIVE (LEFT)—THIRD SPEED POWER FLOW (Fig. 7-117)

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Applied

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Ineffective

In direct drive, engine torque is transmitted from the converter to the drive sprocket, through the link assembly, to the driven sprocket and through the forward clutch to the mainshaft and rear internal gear. Because the direct clutch is applied, equal power is transmitted to sun gear shaft and sun gear. Since both sun gear and internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive or a ratio of 1:1.

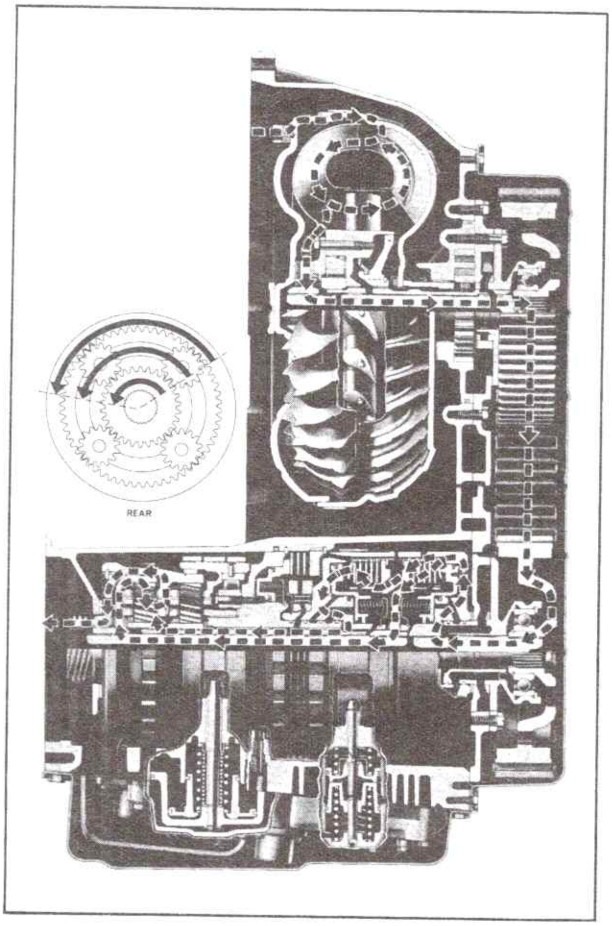


Fig. 7-117 Drive (Left) - Third Gear

OIL FLOW (Fig. 7-118)

As vehicle speed and governor pressure increase, force of governor oil acting on the 2-3 shift valve overcomes the force of 2-3 shift valve spring and modulator oil. This allows the 2-3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage.

Direct clutch oil from the 2-3 shift valve is directed to the:

1. Direct Clutch
2. Front Accumulator Piston
3. 3-2 Valve

Basic Control

Direct clutch oil from the 2-3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch. Simultaneously, direct clutch oil is fed to the front accumulator piston. Pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch apply.

Direct clutch oil is also supplied to the 3-2 valve to move the valve against modulator pressure. This cuts off modulator oil to the 1-2 regulator and 2-3 modulator valves and allows the transmission to utilize the torque multiplying characteristics of the variable pitch converter.

Summary

The forward, intermediate and direct clutches are applied. The transmission is in third gear (direct drive.)

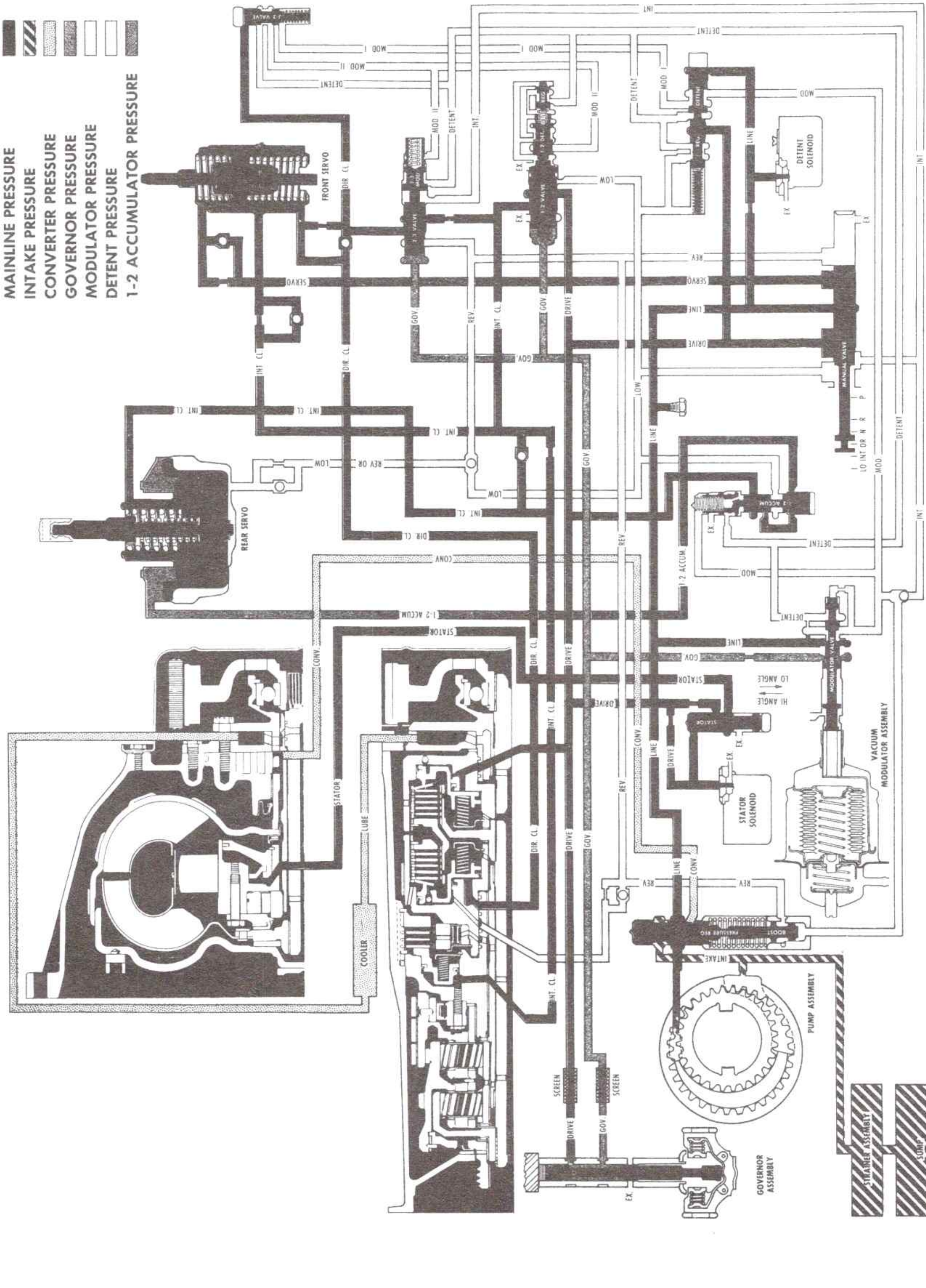


Fig. 7-118 Drive (Left) - Third Gear

PART THROTTLE 3-2 DOWNSHIFT POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released in 2nd

Direct Clutch - Applied in 3rd

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective in 2nd

Intermediate Sprag - Ineffective in 3rd

In second speed, Fig. 7-115, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against clockwise rotation. Turbine torque through the drive sprocket, link assembly and driven sprocket to the forward clutch is now applied through the mainshaft to the rear internal gear in a counterclockwise direction.

Counterclockwise rotation of the rear internal gear turns the rear pinions counterclockwise against the stationary sun gear. This causes the output carrier and output flange to turn counterclockwise in a reduction ratio of approximately 1.48:1.

OIL FLOW (Fig. 7-119)

A part throttle 3-2 downshift can be accomplished below approximately 30 mph by depressing the accelerator far enough to raise modulator pressure to approximately 81 psi. Modulator pressure and the 3-2 valve spring will move the 3-2 valve against direct clutch oil and allow modulator oil to act on the 2-3 modulator valve, moving it against the 2-3 shift valve and governor oil. Shifting the transmission to second speed, as the direct clutch oil passages are open to exhaust through lo-oil passages.

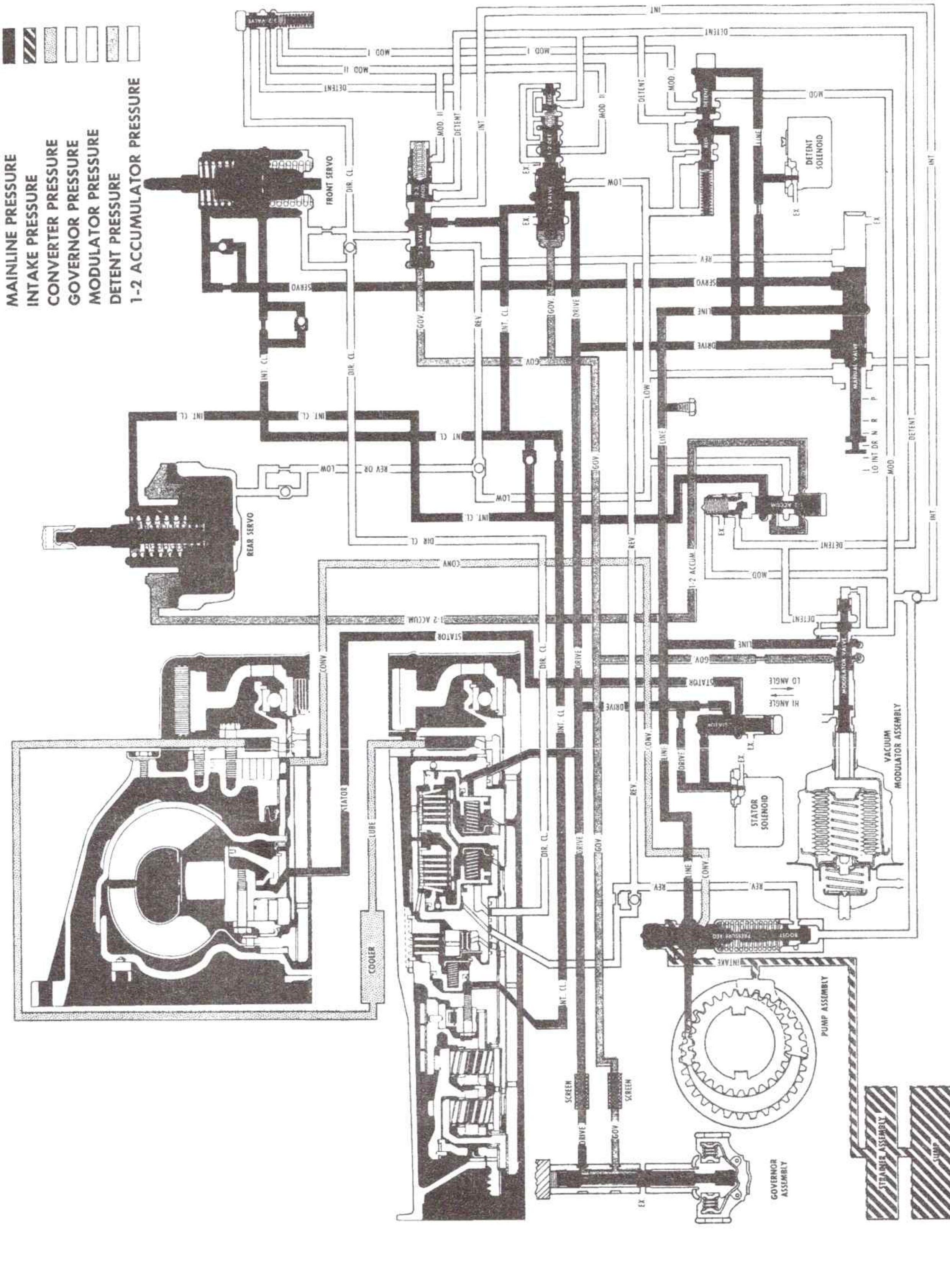


Fig. 7-119 Part Throttle - 3-2 Downshift

DETENT 3-2 DOWNSHIFT POWER FLOW

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released in 2nd

Direct Clutch - Applied in 3rd

Front Band - Released

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective in 2nd

Intermediate Sprag - Ineffective in 3rd

In second speed, Fig. 7-115, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against clockwise rotation. Turbine torque through the drive sprocket, link assembly and driven sprocket to the forward clutch is now applied through the mainshaft to the rear internal gear in a counterclockwise direction.

Counterclockwise rotation of the rear internal gear turns the rear pinions counterclockwise against the stationary sun gear. This causes the output carrier and output flange to turn counterclockwise in a reduction ratio of approximately 1.48:1.

OIL FLOW (Fig. 7-120)

While operating at speeds below approximately 70 mph a forced or detent 3-2 downshift is possible by depressing the accelerator to 60° throttle opening. This energizes the switch at the carburetor and actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a small orifice.

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 70 psi and called detent oil. Detent oil is then routed to the:

1. Modulator passages
   a. 3-2 Valve
   b. 2-3 Modulator Valve
   c. 1-2 Detent Valve
2. Detent Passages
   a. 1-2 Regulator Valve
   b. 2-3 Modulator Valve
   c. 1-2 Primary Accumulator Valve
   d. Modulator Valve

Detent oil in the modulator passage and at the 2-3 modulator valve will close the 2-3 shift valve, shifting the transmission to second gear.

Detent 2-1 Downshift

A detent 2-1 downshift can also be accomplished below approximately 20 mph because detent oil is directed to the 1-2 regulator valve. This allows detent oil to act on the 1-2 regulator, and 1-2 detent valve to close the 1-2 shift valve, shifting the transmission to first gear.

Detent oil is also directed to the modulator valve to prevent modulator pressure from regulating below 70 psi at high speeds or at high altitudes.

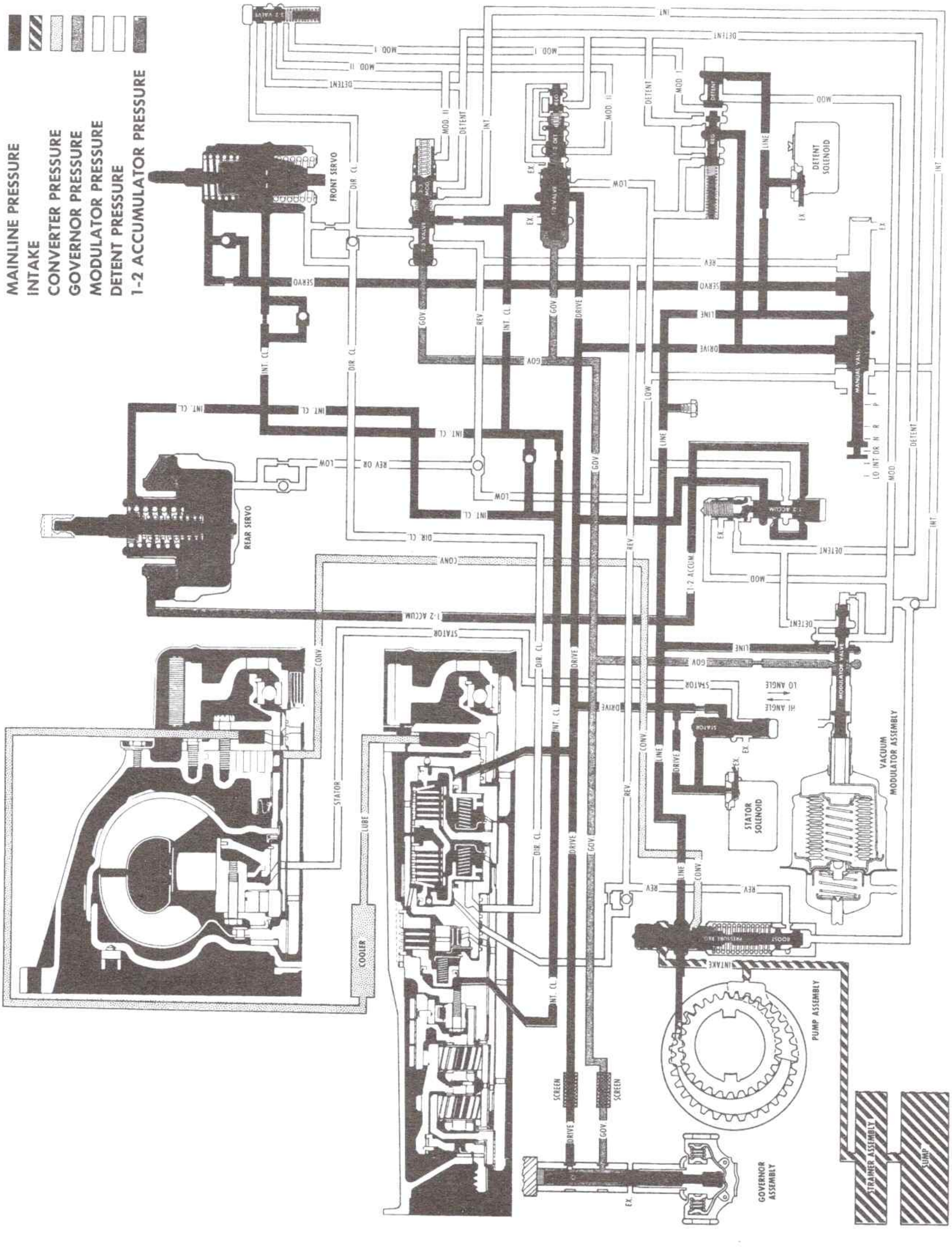


Fig. 7-120 Detent 3-2 Downshift

DRIVE (RIGHT)—SECOND SPEED POWER FLOW (Fig. 7-121)

Forward Clutch - Applied

Roller Clutch - Ineffective

Direct Clutch - Released

Front Band - Applied

Rear Band - Released

Intermediate Clutch - Applied

Intermediate Sprag - Effective

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against clockwise rotation. Turbine torque through the drive sprocket, link assembly and driven sprocket to the forward clutch is now applied through the mainshaft to the rear internal gear in a counterclockwise direction.

Counterclockwise rotation of the rear internal gear turns the rear pinions counterclockwise against the stationary sun gear. This causes the output carrier and output flange to turn counterclockwise in a reduction ratio of approximately 1.48:1.

In second speed - Drive (right), engine braking is provided by the front band as it holds the sun gear fixed. Without the band applied, the sun gear would overrun the intermediate sprag.

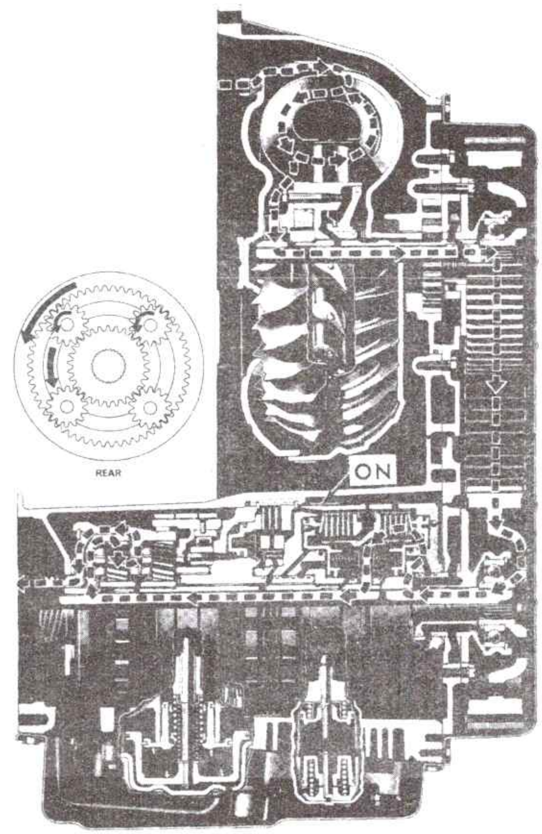


Fig. 7-121 Drive (Right) - Second Gear

OIL FLOW (Fig. 7-122)

When the selector lever is in Drive (right), intermediate oil from the manual valve is directed to the:

1. Pressure Boost Valve
2. 2-3 Shift Valve

Intermediate oil at the boost valve will increase line pressure to 150 psi. This increased intermediate oil pressure at the 2-3 shift valve will close the 2-3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second speed - Drive (right), it cannot upshift to third gear.

Summary

The forward and intermediate clutches and front band are applied. The transmission is in second gear - Drive (right).

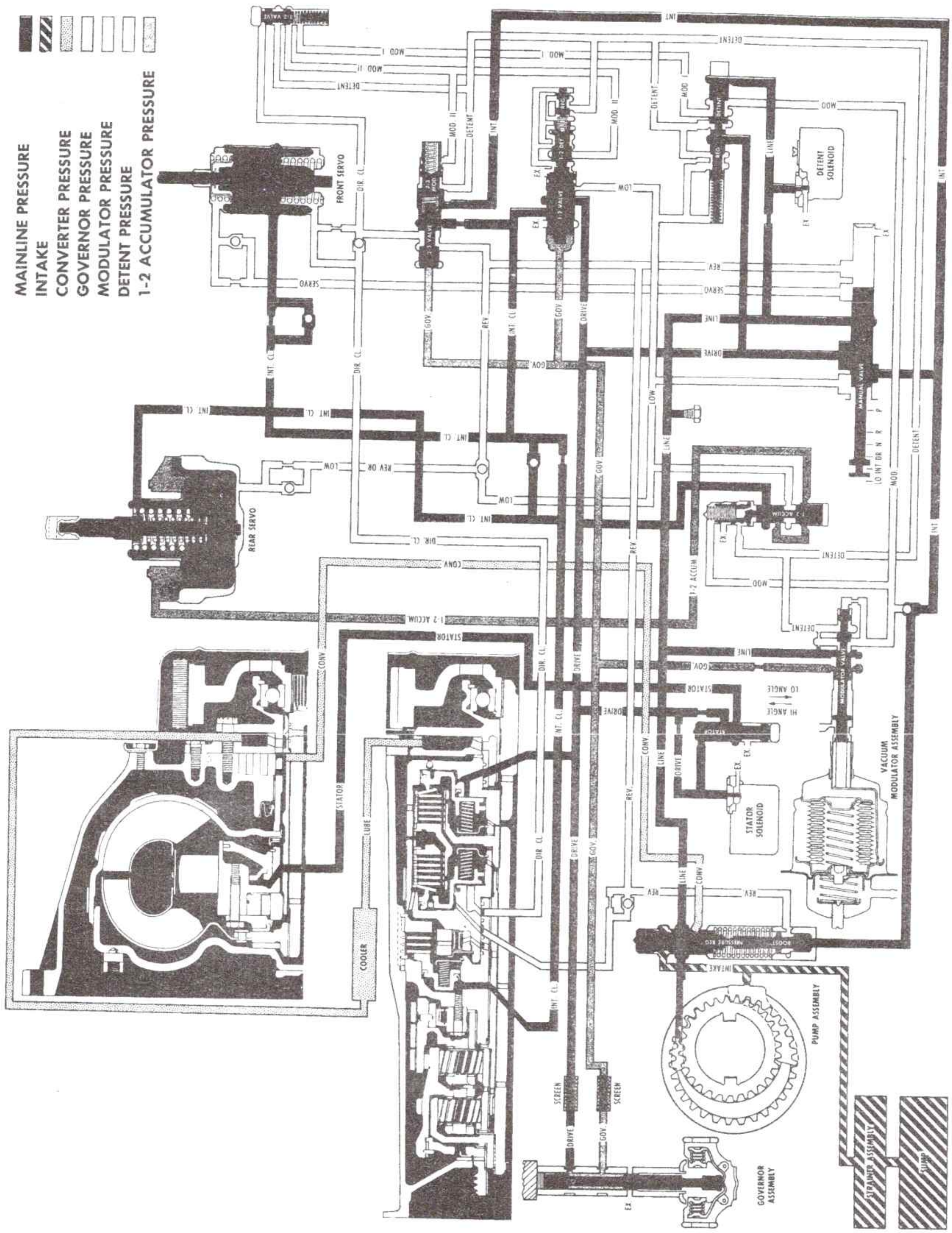


Fig. 7-122 Drive (Right) - Second Gear

LO RANGE—FIRST SPEED POWER FLOW (Fig. 7-123)

Forward Clutch - Applied

Roller Clutch - Effective

Direct Clutch - Released

Front Band - Released

Rear Band - Applied

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

With the selector lever in Lo range, the forward clutch is applied. This delivers turbine torque, through the drive sprocket, link assembly and driven sprocket, to the mainshaft and turns the rear internal gear in a counterclockwise direction. (Converter torque ration = approximately 2.00:1 at stall.)

Counterclockwise motion of the rear internal gear causes the rear pinions to turn counterclockwise to drive the sun gear clockwise. In turn, the sun gear drives the front pinions counterclockwise, thus turning the front internal gear, output carrier, and output flange counterclockwise in a reduction ratio of approximately 2.48:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and roller clutch assembly to the transmission case. (Total stall ratio = approximately 5.00:1.)

Downhill or overrun braking is provided in Lo range by applying the rear band, as this prevents the reaction carrier from overrunning the Lo roller clutch.

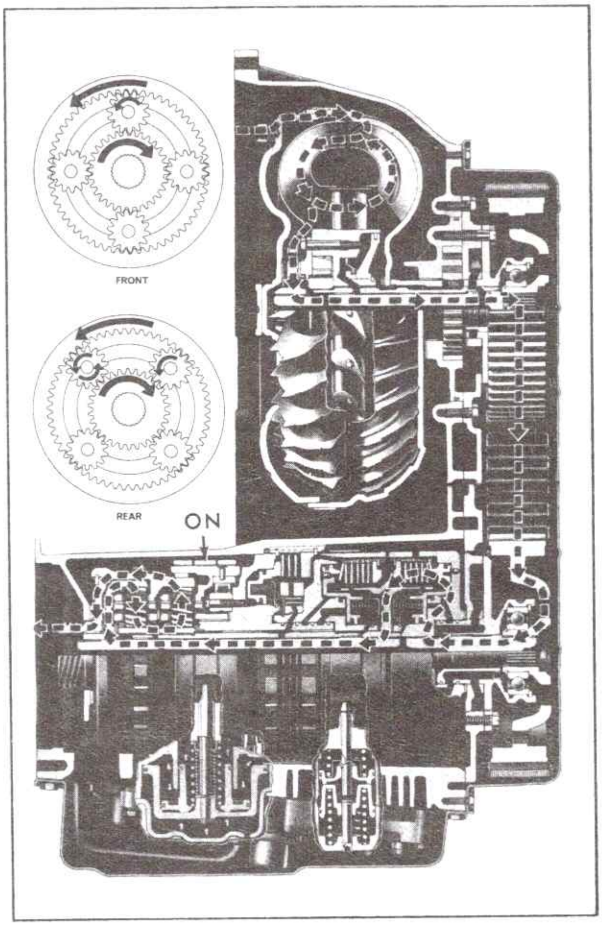


Fig. 7-123 Lo Range - First Gear

OIL FLOW (Fig. 7-124)

Maximum downhill braking can be attained at speeds below 40 mph, with the selector lever in Lo position as this directs Lo oil from the manual valve to the:

1. Rear Servo
2. 1-2 Accumulator Valve
3. Detent Regulator Valve
4. 1-2 Shift Valve

Basic Control

Lo oil flows past a ball check to the apply side of the rear servo piston and to the 1-2 accumulator valve to raise the 1-2 accumulator oil to line pressure for a smooth band apply.

Lo oil acts on the detent regulator valve. Combined with the detent spring, Lo oil holds the detent valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1-2 regulator and 1-2 detent valve overcomes governor oil on the 1-2 shift valve at any vehicle speed below approximately 40 mph, and the transmission will shift to first gear. Oil also acts on a small area of the 1-2 shift valve to prevent the 2-1 shift occuring at too high a vehicle speed.

In first speed - Lo range, the transmission cannot upshift to second speed regardless of vehicle or engine speed.

Summary

The forward clutch and rear band are applied. The transmission is in first speed - Lo range.

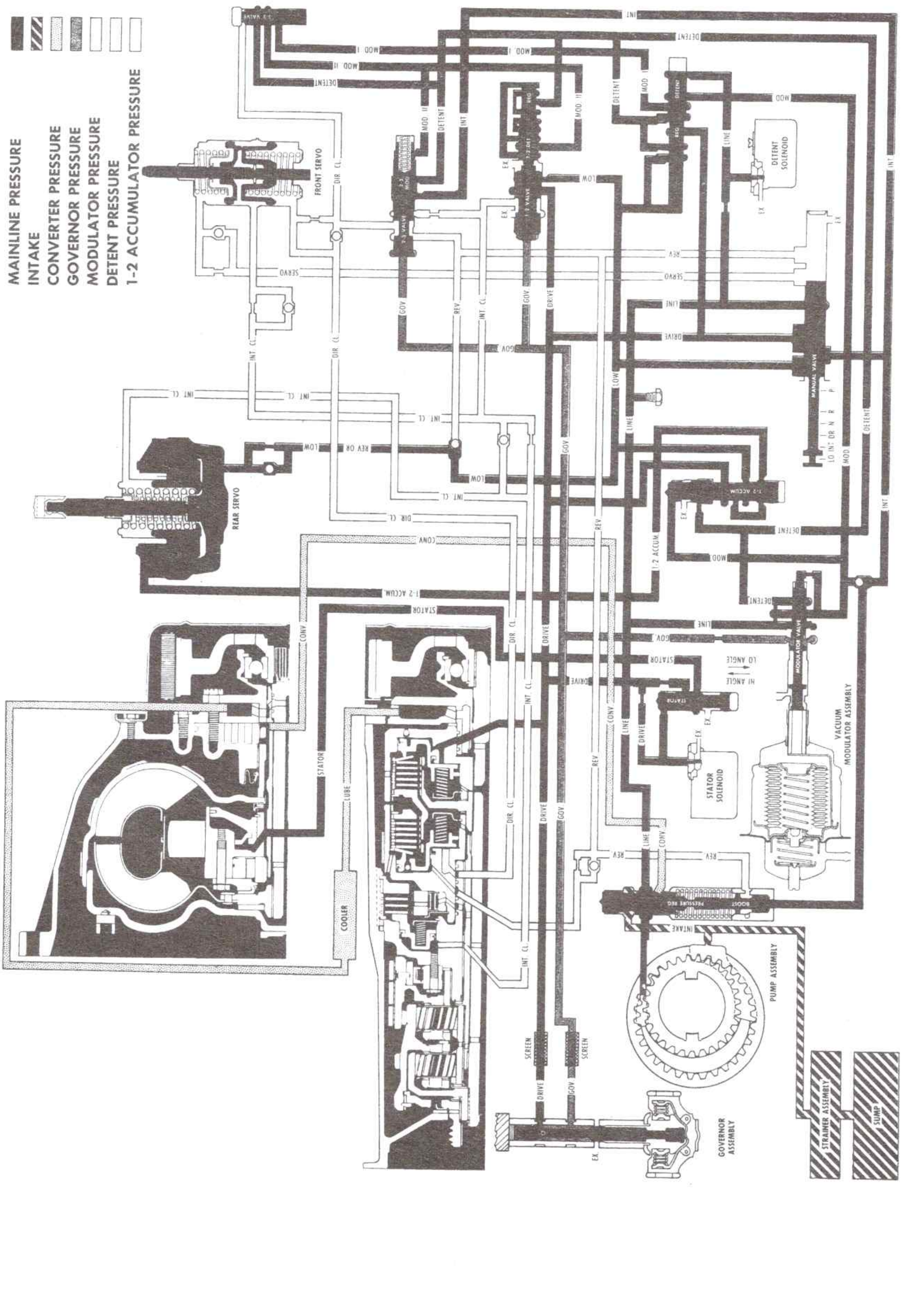


Fig. 7-124 Lo Range - First Gear

REVERSE
POWER FLOW (Fig. 7-125)

Forward Clutch - Released

Roller Clutch - Ineffective

Direct Clutch - Applied

Front Band - Released

Rear Band - Applied

Intermediate Clutch - Released

Intermediate Sprag - Ineffective

In Reverse, the direct clutch is applied to direct turbine torque through the drive sprocket, link assembly and driven sprocket to the sun gear shaft and sun gear. The rear band is applied, holding the reaction carrier.

Counterclockwise torque to the sun gear causes the front pinions and front internal gear to turn clockwise in reduction. The front internal gear is connected directly to the output flange, thus providing the reverse output gear ratio of approximately 2.08:1. The reverse torque multiplication at stall (converter and gear ratios) is approximately 4.00:1.

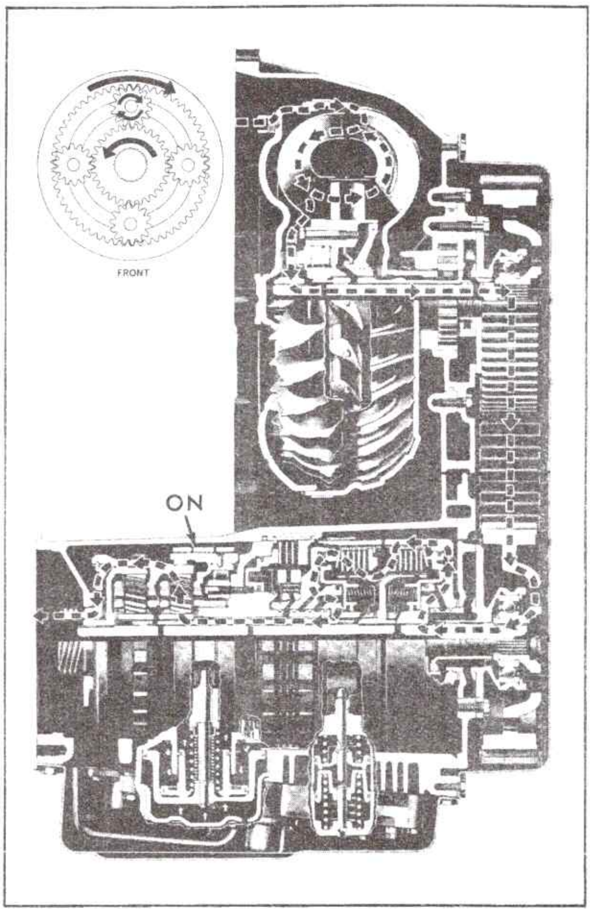


Fig. 7-125 Reverse

OIL FLOW (Fig. 7-126)

When the selector lever is moved to the Reverse position, the manual valve is positioned to allow line pressure to enter the reverse circuit. Reverse oil then flows to the:

1. Direct Clutch
2. 2-3 Shift Valve
3. Rear Servo Piston
4. Pressure Boost Valve

Basic Control

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2-3 shift valve. From the 2-3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply direct clutch.

Reverse oil flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil also acts on the pressure boost valve to boost line pressure.

Summary

The direct clutch and the rear band are applied. The transmission is in Reverse.

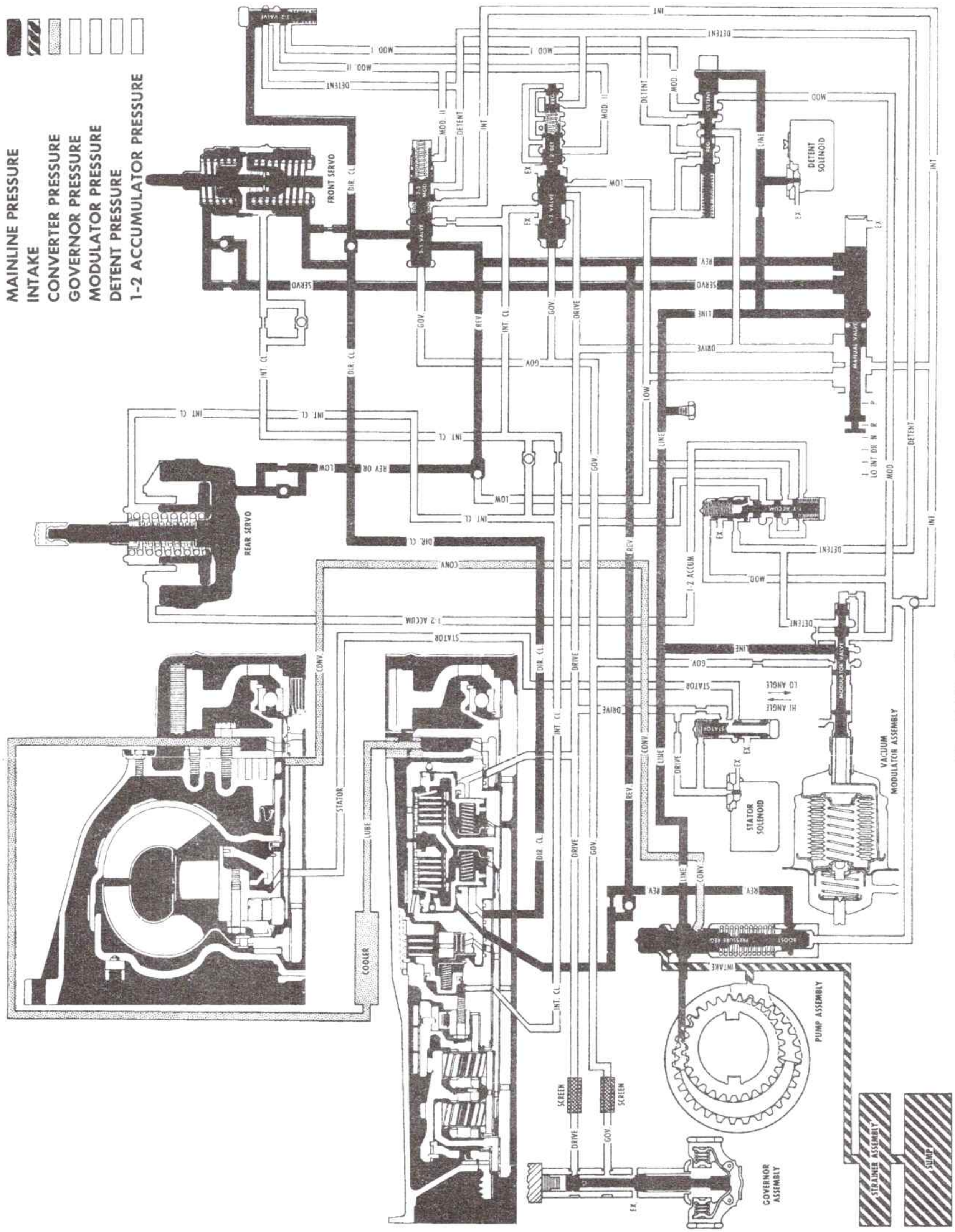
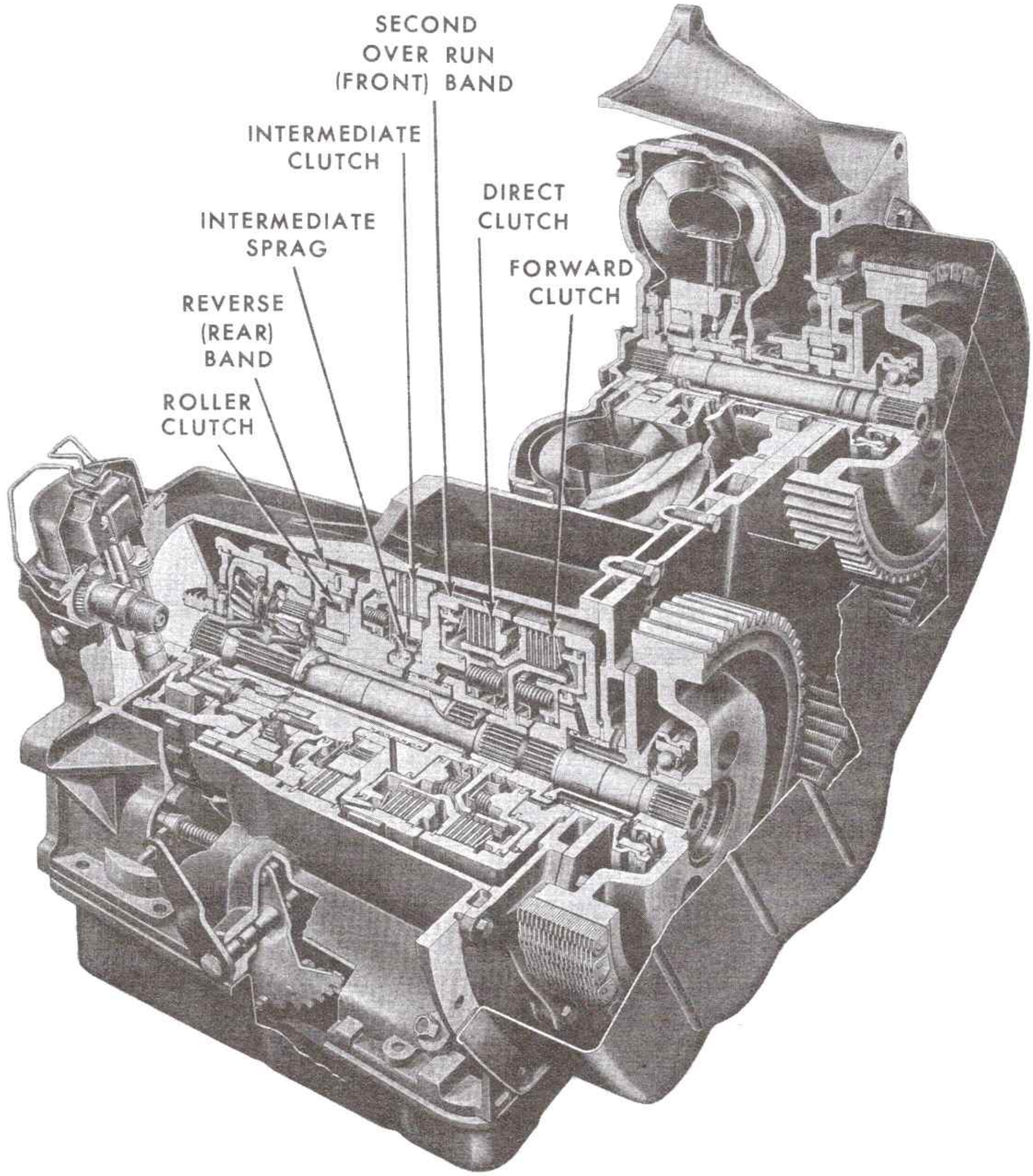


Fig. 7-126 Reverse



SELECTOR POSITION	PUMP PRESSURE	FORWARD CLUTCH	DIRECT CLUTCH	2ND OVERRUN BAND	INT. CLUTCH	INT. SPRAG	ROLLER CLUTCH	REV. BAND
PARK—NEUT.	70-150	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DRIVE 1	70-150	ON	OFF	OFF	OFF	OFF	ON	OFF
LEFT 2	70-150	ON	OFF	OFF	ON	ON	OFF	OFF
3	70-150	ON	ON	OFF	ON	OFF	OFF	OFF
DRIVE 1	150	ON	OFF	OFF	OFF	OFF	ON	OFF
RIGHT 2	150	ON	OFF	ON	ON	ON	OFF	OFF
LO 1	150	ON	OFF	OFF	OFF	OFF	ON	ON
2	150	ON	OFF	ON	ON	ON	OFF	OFF
REV.	107.5-230	OFF	ON	OFF	OFF	OFF	OFF	ON

Fig. 7-127 Band, Sprag and Clutch Application Chart

SERVICE INFORMATION

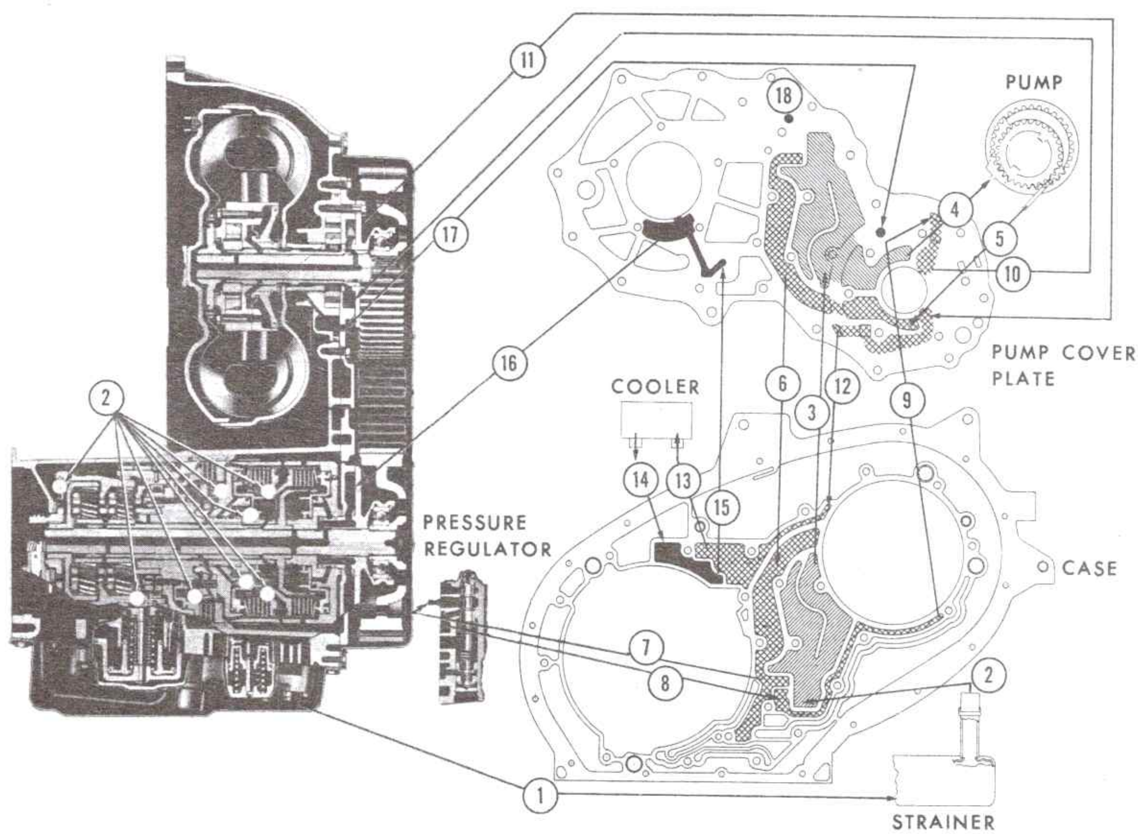
NOTE: The following information is applicable to the Fleetwood Eldorado only. Where service procedures are similar to the Turbo Hydra-matic transmission used on other 1967 Cadillac models, reference will be made to the appropriate note in the forward part of this section.

19. Turbo Hydra-Matic Diagnosis

The diagnosis procedures for the Turbo Hydra-matic transmission used on the Fleetwood Eldorado are identical to the procedures given in Note 1, with the following exceptions:

1. Figures 7-128 through 7-131 are to be used in place of Figure 7-20 and 7-21 when diagnosing a Fleetwood Eldorado Turbo Hydra-matic transmission.

2. Transmission Noise - Sprocket and Link Assembly.



1 OIL FROM SUMP TO STRAINER
2 STRAINER TO CASE PASSAGE
3 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
4 PUMP COVER PLATE PASSAGE TO PUMP
5 PUMP TO PUMP COVER PLATE PASSAGE
6 PUMP COVER PLATE PASSAGE TO CASE PASSAGE
7 CASE PASSAGE TO PRESSURE REGULATOR VALVE
8 PRESSURE REGULATOR VALVE TO CASE PASSAGE
9 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
10 PUMP COVER PLATE PASSAGE TO CONVERTER
11 CONVERTER TO CONVERTER OUT-CHECK VALVE AND PUMP COVER PLATE PASSAGE
12 PUMP COVER PLATE PASSAGE TO CASE PASSAGE
13 CASE PASSAGE TO COOLER
14 COOLER RETURN TO CASE PASSAGE
15 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
16 PUMP COVER PLATE PASSAGE TO TRANSMISSION POWER TRAIN (ALL INTERNAL LUBRICATION)
NOTE: THE NUMBERS IN THE CROSS SECTION INDICATE THAT THERE ARE ADDITIONAL LUBRICATION HOLES IN THIS AREA THAT ARE NOT SHOWN IN THE CROSS SECTION.
17 FRONT SEAL DRAIN BACK HOLE
18 PRESSURE REGULATOR VENT HOLE

Fig. 7-128 Lubrication Chart

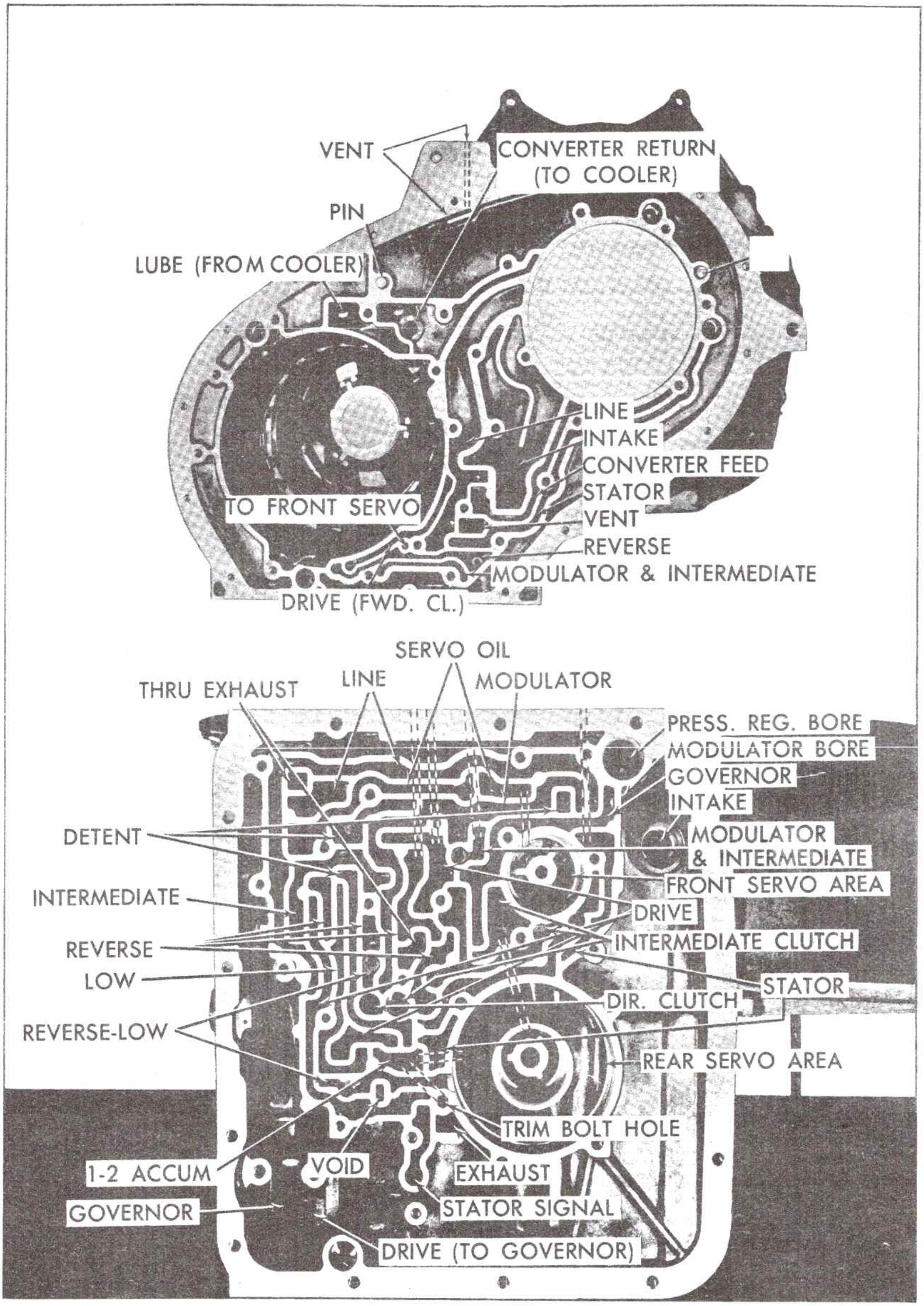


Fig. 7-129 Case Oil Passages - Front View and Bottom View

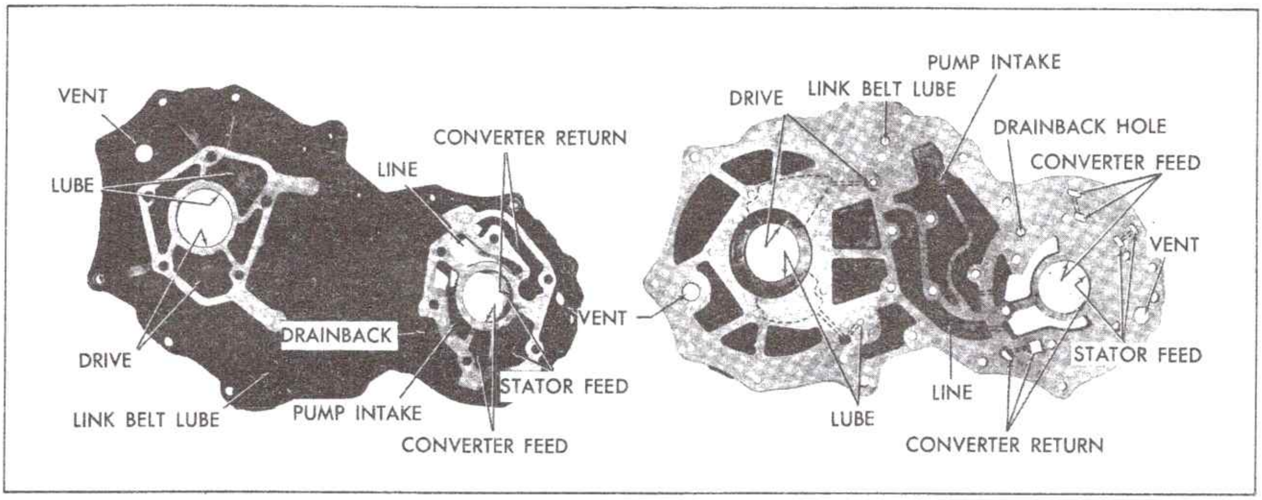


Fig. 7-130 Pump Cover Oil Passages

a. Link assembly too long. Sounds similar to pop corn popping. (There will be a rough burr along the teeth of the drive sprocket if the link assembly is too long). Replace sprocket and link assembly.

b. Drive or Driven sprocket teeth damaged.

c. Engine mounts worn or damaged.

20. Fluid Leakage Precautions

The fluid leakage precautions are listed in Note 2.

21. Points of Possible Oil Leaks

When checking for oil leaks, first determine whether leak originates from transmission or engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating leaks. If the color of the dye cannot be detected in the transmission fluid, add a red aniline dye preparation to the fluid. Red dye appearing in the leaking oil will give positive identification as to the location of the leak.

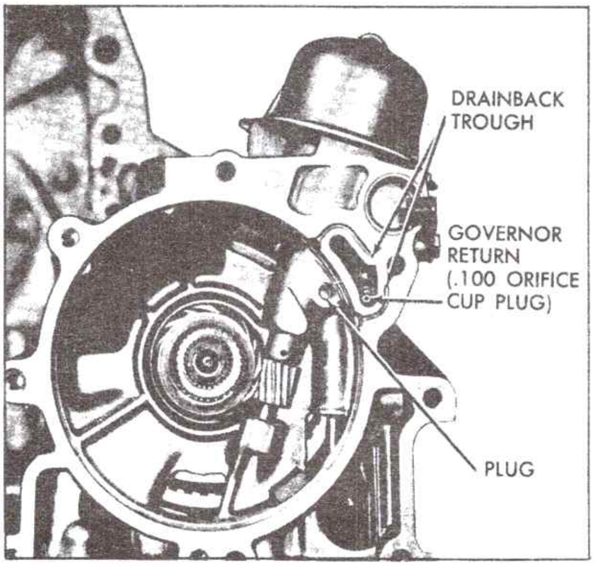


Fig. 7-131 Governor Oil Passages

If oil leak is found to be in transmission, check for leak in following areas:

a. Rear End

It will be necessary to remove converter cover to determine location of leaks at rear end. To correct leaks at rear end, it will be necessary to remove transmission from car.

1. Pump oil seal leak - Check pump oil seal to make certain it is correctly installed and not damaged.

When installing a new pump oil seal, make certain that bore is free from foreign material and that garter spring on seal is correctly positioned. Check finish of converter neck and bearing surface in pump body.

2. Pump assembly-to-case O-ring damaged.

3. Converter - Inspect converter for indications of leakage. See Note 15 for checking procedure.

4. Vent fitting damaged.

b. Cover and Plate Assembly Sprocket Housing Leak

1. Attaching bolts not correctly torqued.

2. Housing to case gasket improperly installed or damaged.

3. Housing to case gasket face not flat.

c. Final Drive to Transmission Leak

1. Attaching bolts not correctly torqued.

2. Final drive to transmission gasket improperly installed or damaged.

3. Mounting surfaces not flat.

d. Transmission Case

1. Speedometer driven gear housing retainer attaching screw loose. Tighten to 18 foot-pounds.

2. Speedometer driven gear housing O-ring or lip seal damaged.

3. Governor cover bale-type attaching retainer not tight.

4. Damaged governor O-ring.

5. Solenoid connector terminal O-ring damaged.

6. Manual shaft O-ring damaged.

7. Vacuum modulator damaged.

8. Vacuum modulator retainer screw loose. Tighten to 18 foot-pounds.

9. Vacuum modulator diaphragm damaged. Disconnect vacuum line on vacuum modulator; if red transmission fluid appears on vacuum side, modulator is defective.

NOTE: If transmission is found to be consistently low on oil, check vacuum modulator to make certain diaphragm has not ruptured. Apply suction to vacuum tube and check for leaks. A ruptured diaphragm would allow transmission oil to be drawn into intake manifold and vacuum line. Usually the exhaust will be excessively smoky due to transmission oil added to the combustion.

10. Bottom pan gasket damaged.

11. Bottom pan attaching screws loose. Tighten to 12 foot-pounds.

12. Line pressure plug not tight. Tighten to 10 foot-pounds.

13. Porous or cracked casting.

14. Vent pipe

a. Transmission over-filled.

b. Water in oil

c. Pump to case gasket mispositioned.

d. Foreign material between pump and case, or between pump cover and body.

e. Case - Porous, pump face improperly machined.

f. Pump - Shy of stock, porous.

e. Oil Cooler Pipe Connections

1. Outside oil cooler pipe connections improperly installed or damaged. Also connectors in radiator and transmission.

2. Oil cooler pipe connections not tight. Tighten to 28 foot-pounds at transmission and 40 foot-pounds at radiator.

3. Flare on oil cooler pipes damaged at radiator or transmission.

f. Filler Pipe

1. O-ring damaged or improperly installed on pipe.

2. Filler pipe not fully seated in case.

g. Internal Leaks

It will be necessary to remove bottom pan to determine location of internal leaks.

1. Governor pipes damaged.

2. Rear servo cover attaching screws not tight. Tighten to 18 foot-pounds.

3. Rear servo cover gasket damaged.

4. Control valve assembly-to-spacer or case gaskets damaged.

5. Control valve assembly attaching screws loose. Tighten to 8 foot-pounds.

6. Solenoid gaskets damaged.

7. Solenoid attaching screws loose. Tighten to 8 foot-pounds.

8. Intake pipe O-ring damaged.

9. Rear servo square cut O-ring improperly installed or damaged.

22. Manual Linkage Adjustment (Fig. 7-132)

1. Loosen adjusting screw on relay bracket.

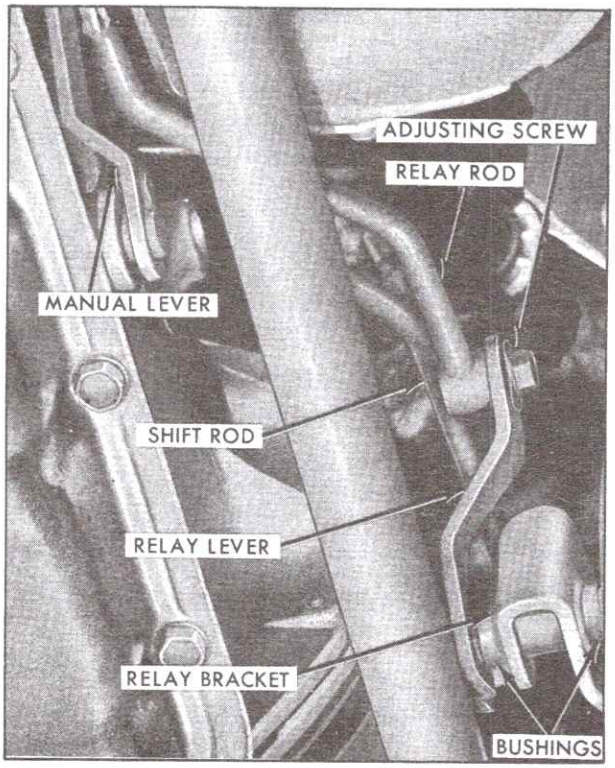


Fig. 7-132 Adjusting Manual Linkage

2. Pull relay rod up to position transmission shift valve in Park, then push rod down to the third (Neutral) step. Make sure rod is centered in this detent position.

3. Position selector lever in Neutral against quadrant stop in steering column.

4. Tighten relay rod adjusting screw, making sure shift lever is held against Neutral stop while this operation is being performed.

5. Check operation of selector lever by performing the following steps:

a. Lift lever and move to Neutral detent. (This is the detent in the transmission.) Release the lever and check to make sure that the lever is not riding up on top of the Neutral stop nor has excessive clearance to it.

b. Move lever to Drive detent. There should be a slight travel of the lever beyond this detent until the drive stop in the steering column is reached.

c. Move lever to Reverse detent and check as in b above.

NOTE: Whenever linkage is readjusted, check for proper operation of neutral safety switch.

23. Transmission Downshift Switch Adjustment

The procedure for adjusting the transmission downshift switch is described in Note 5.

24. Stator and Downshift Solenoid Circuit Check

The procedure for checking the stator and downshift solenoid circuits is described in Note 6.

25. Checking and Adding Fluid

CAUTION: Car level and oil temperature are particularly important when checking fluid level on a Turbo Hydra-matic transmission. Careful attention to the following procedures is necessary in order to determine the actual fluid level.

a. Turbo Hydra-Matic Oil Recommendations

Whenever fluid is added, use only Type "A" Transmission Fluid, designated AQ-ATF, followed by three or four numerals and the suffix letter "A". Only a fluid bearing the suffix letter "A" in its designation should be used, as this indicates a superior grade of transmission fluid.

The transmission dipstick and filler tube on the 1967 Fleetwood Eldorado is located under the hood at the left center side of the engine.

The bottom pan should be drained every 24,000 miles or 2 years, whichever occurs first, and fresh fluid added to obtain the proper level on the dipstick, Fig. 7-133. For cars subjected to heavy

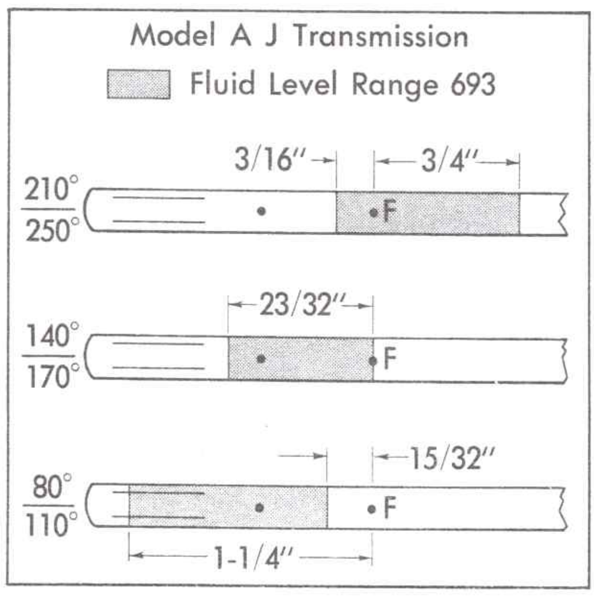


Fig. 7-133 Transmission Oil Level (693 Only)

city traffic during hot weather, or in commercial use, when the engine is regularly idled for prolonged periods, the bottom pan should be drained every 12,000 miles.

The oil intake system incorporates an intake pipe and strainer assembly that should be replaced after the first 24,000 miles or 2 years, whichever occurs first. In any case of a major transmission failure, the strainer assembly must be replaced.

b. Checking and Adding Fluid

Fluid level should be checked at every engine oil change. The full "F" and "ADD" dimple marks on the transmission dipstick indicate one pint difference. Correct fluid level is determined at normal operating temperature (180°F - 190°F). Careful attention to transmission oil temperature is necessary, as proper fluid level at low operating temperatures will be below the "ADD" mark on the dipstick, Fig. 7-133, and proper fluid level at higher operating temperatures will rise above the full "F" mark. Fluid level must always be checked with car on level surface, and with engine running to make certain converter is full. To determine proper fluid level, proceed as follows:

1. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

2. Reduce engine speed to slow idle and check fluid level.

3. With engine running, add fluid, if necessary, to bring to proper level, Fig. 7-133.

CAUTION: Do not overfill, as foaming might occur when fluid heats up. If fluid level is too low, especially when cold, complete loss of dirve may result after quick steps. Extremely low fluid levels will result in damage to the transmission.

c. Draining Bottom Pan and Replacing Intake Pipe and Strainer Assembly

To drain bottom pan only, eliminate steps 4 and 5.

1. Raise car on hoist or place on jack stands, and provide container to collect draining oil.

2. Remove bottom pan and gasket. Discard gasket.

3. Drain fluid from bottom pan. Clean pan with solvent and dry thoroughly with clean compressed air.

4. Remove intake pipe and strainer assembly. Remove and discard intake pipe O-ring.

5. Install new intake pipe O-ring into pipe bore in transmission case and install new intake pipe and strainer assembly.

6. Install new gasket on bottom pan and install bottom pan. Tighten bottom pan attaching screws to 12 foot-pounds.

7. Lower car and add 5 quarts of transmission fluid through filler tube when replacing intake pipe and strainer assembly. When draining bottom pan only, add 4 quarts of transmission fluid.

8. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

9. Reduce engine speed to slow idle and check fluid level. Add fluid to bring to proper level, Fig. 7-133.

d. Adding fluid to Fill Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic transmission and converter assembly is approximately 13 quarts, but correct level is determined by mark on dipstick rather than by amount added. It is important that proper level be maintained. In cases of transmission overhaul, when a complete fill is required, including converter, proceed as follows:

1. Add 9 quarts of transmission fluid through filler tube.

2. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

3. Reduce engine speed to slow idle.

4. Check fluid level and add additional fluid to bring to proper level, Fig. 7-133.

e. Sprocket Housing Cover Removal

If the sprocket housing cover is removed, add transmission oil as described in Note b.

26. Towing Instructions

1967 Cadillac Fleetwood Eldorado cars cannot be started by pushing, and this procedure should never be attempted. If the car cannot be started in the normal manner or by the use of jumper cables, it should be towed to the nearest authorized service facility.

It is recommended that the car be towed with the front wheels off the ground. The car can be towed, however, with the rear wheels off the ground, if there is damage to the rear wheel area. In this event, the selector lever should be placed

in Neutral "N" position, and the vehicle towed at speeds not to exceed 35 mph for distances up to 50 miles.

Before towing, check transmission fluid level. Fluid level must be above full mark on the dipstick with engine "OFF". Always tow car with transmission shift lever in Neutral position.

If tow requires raising front or rear of car, wheels should be lifted just slightly off the ground. When towing with rear wheels raised, tie down steering wheel with front wheels in straight ahead position.

27. Units That Can Be Removed with Transmission in Car

The following units can be removed from the transmission without removing transmission from car.

While the detailed procedure for removing each of the units is not outlined separately, the procedures covered under the transmission disassembly and assembly will apply.

a. Governor Assembly

Removal - Note 30b

Disassembly - Note 31k

Installation - Note 31k

b. Speedometer Driven Gear Assembly

Removal - Note 30c

Installation - Note 31k

c. Intake Pipe and Strainer Assembly and Bottom Pan

Removal - Note 30d

Installation - Note 31j

d. Control Valve Assembly, Governor Pipes, Detent Spring and Roller Assembly, Stator Solenoid and Check Balls

Removal - Note 30f

Disassembly - Note 31i

Installation - Note 31i

e. Vacuum Modulator and Valve

Removal - Note 30a

Installation - Note 31j

f. Pressure Regulator

Removal - Note 30e

Installation - Note 31j

g. Front Servo and Rear Servo and Accumulator Assembly

Removal - Note 30g

Disassembly - Note 31h

Installation - Note 31h

h. Detent Lever, Manual Shaft, and Parking Linkage

Removal - Note 30i

Installation - Note 31h

28. Transmission Removal and Installation (Fig. 7-134)

a. Removal

1. Disconnect negative battery cable.

2. Remove hood assembly as described in Section 11, Note 2.

3. Remove transmission dip stick.

4. Remove bolt securing filler tube bracket to exhaust manifold and remove filler tube.

5. Remove and discard O-ring on filler tube.

6. Remove bolts at locations "A", "B" and "C", securing final drive case to transmission.

7. Disconnect speedometer cable from governor assembly.

8. Disconnect oil cooler pipes at transmission and at radiator, using Oil Cooler Pipe Wrench, J-21477. Cap pipes and plug connector holes in transmission and radiator.

9. Remove bolt securing cooler pipe bracket to final drive bracket and position pipes outboard of governor assembly.

10. Remove nut at location "H", securing final drive case to transmission.

11. Remove bolts at locations "I", "J", "K" and "L", securing transmission to engine and adapter plate.

12. Remove upper left bolt securing rear motor mount bracket to transmission.

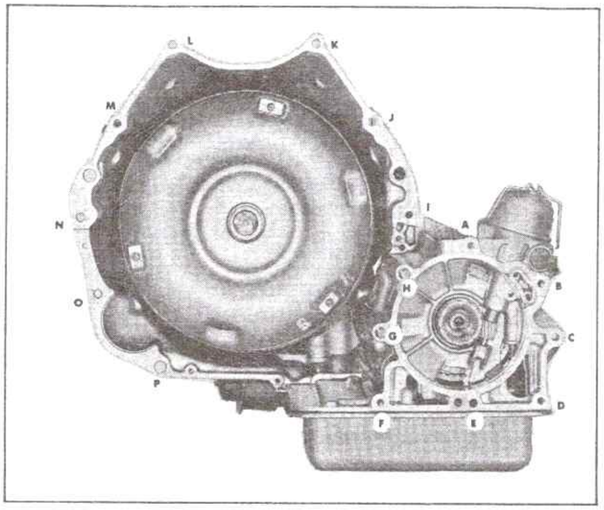


Fig. 7-134 Transmission Attaching Bolt Locations

13. Remove nut securing ground strap to left side of cowl and remove ground strap from cowl.

14. Remove upper left nut securing converter cover plate to transmission by using a 7/16 inch universal socket and extension, and reaching underneath left exhaust manifold.

NOTE: Removal of this screw can be facilitated by having a helper underneath car, verbally guide socket onto nut.

15. Position cable (with looped ends) under engine intake manifold and hook looped ends to chain fall. Take up slack in chain fall and cable, putting engine mounts under tension.

16. Position safety chain over top of transmission.

17. Raise car and place on jack stands, adjusting chain fall as necessary.

18. Disconnect leads from starter motor.

19. Remove bolt at location "O" securing starter motor to transmission case and remove ground strap from bolt.

20. Holding starter, remove bolt at location "P" and remove starter.

21. Remove three remaining screws securing converter cover plate to transmission and remove cover plate.

22. Position transmission jack, equipped with front end drive transmission adapter plate, to transmission and install nut and bolt securing adapter brace to transmission at starter motor lower mounting bolt hole, Fig. 7-135.

23. Disconnect electrical connector from transmission connector.

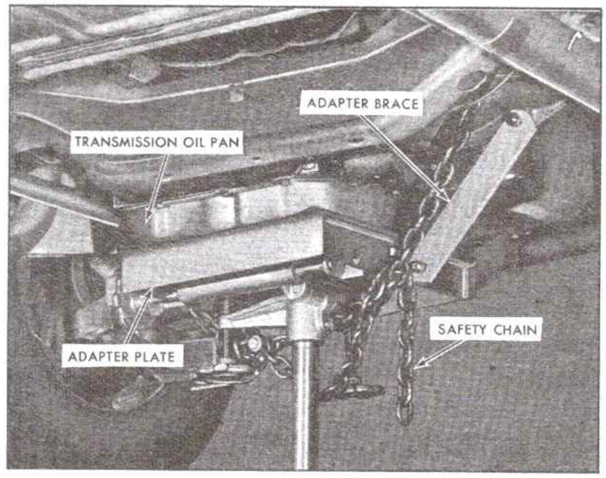


Fig. 7-135 Positioning Transmission Jack to Transmission

24. Remove vacuum pipe from vacuum modulator.

25. Secure transmission to transmission jack adapter plate with safety chain.

26. Remove three flex plate to converter attaching bolts.

NOTE: This can be done by installing a 9/16-18 bolt and washer into end of crankshaft at harmonic balancer, after removing cork plug, and rotating converter and flex plate until bolts are accessible for removal. Do not pry on flex plate ring gear to rotate flex plate and converter, as flex plate may be damaged.

27. Remove bolts at locations "M" and "N" securing transmission to engine and adapter plate.

28. Remove cotter pin securing relay rod to manual yoke on left side of transmission and separate relay rod from yoke.

29. Remove bolts at locations "D", "E", "F" and nut at location "G", securing final drive to transmission.

NOTE: Position drain pan under point where transmission and final drive meet as approximately 1-1/2 quarts of transmission fluid will be lost when transmission and final drive are separated.

30. Remove five bolts and washers securing rear of acromat to front cross bar and frame horns and allow acromat to hang free.

31. Through access holes in bottom of front cross bar, remove left bolt and loosen right bolt securing front engine mount to front cross bar.

32. Have helper, using large pry bar, shift engine assembly forward, while technician performing operation uses small pry bar to help

separate transmission from engine and final drive.

CAUTION: Select pry points with care to avoid damaging any components.

33. After initial separation has been made, allow transmission oil to drain at final drive junction.

34. Remove two bolts, on right side, securing rear motor mount bracket to transmission.

35. Through access holes in bottom of transmission support bar, remove two bolts, one each side, securing rear motor mounts to transmission support bar, and position motor mounts and bracket rearward to underbody.

36. While helper pries and holds engine assembly forward, move transmission rearward to disengage transmission case from dowels on engine adapter and to disengage final drive from studs on transmission case. Top of transmission should be tilted slightly rearward.

37. Slowly lower transmission, making certain top of transmission case clears flex plate ring gear and splined input shaft of final drive, until converter is approximately half-way exposed from flex plate.

38. Install Converter Holding Clamp, J-21366, using a 5/16-18 nut to hold clamp screw to transmission case at location "N".

CAUTION: Converter Holding Clamp, J-21366, must be used to avoid the possibility of the converter becoming disengaged when the transmission is removed.

39. Lower transmission from car.

CAUTION: Rear motor mount bracket will follow transmission from car; to avoid damage or injury, remove the bracket as soon as there is sufficient clearance.

40. Remove and discard final drive gasket and clean mounting surface of final drive.

b. Installation

1. Position transmission, on jack equipped with adapter plate, under car.

2. Install new gakset on final drive, after first soaking gasket with transmission fluid.

3. Position rear motor mount bracket on top of transmission support bar against underbody.

4. Raise transmission in place until converter is approximately half-way covered by flex plate, and then remove Converter Holding Clamp, J-21366, from transmission.

5. While helper assists by holding engine assembly forward with pry bar, continue raising transmission, making certain top of transmission case clears splined input shaft of final drive, and position to engine.

6. Position transmission to engine assembly and final drive by aligning the following points in order listed, while helper assists:

a. Studs on transmission case to mounting holes in final drive.

b. Guide holes in transmission case to dowels on adapter.

c. Internal flange on final drive to transmission.

NOTE: As engagement of splined final drive input shaft to transmission is hidden, extreme care must be taken to avoid damaging transmission or final drive assembly.

d. To facilitate engagement of final drive splines, rotate one front wheel while helper holds other.

NOTE: When alignment is complete and proper, gap between final drive case and transmission should not exceed 1/4 inch.

7. Loosely install bolts (3/8-16 x 1-1/4) at locations "D" and "F" attaching transmission to final drive and bolt (3/8-16 x 2-1/2) at location "N" attaching transmission to engine through adapter, alternately tightening bolts to avoid cocking transmission. Do not torque bolts at this time.

8. Working in engine compartment, loosely install bolt (3/8-16 x 1-3/8) at location "J" attaching transmission to adapter. Do not torque bolt at this time.

9. Install bolt (3/8-16 x 1-3/8) at location "M" attaching transmission to adapter plate. Do not torque bolt at this time.

10. Position rear motor mount bracket to transmission and loosely install three bolts securing bracket to transmission.

NOTE: Upper left bolt is installed from engine compartment.

11. Position rear engine mounts and bracket to transmission support bar and loosely install bolts, through access holes in bottom of bar, attaching mounts to bar.

12. Reposition engine assembly, as necessary, and install left bolt securing front motor mount to

front cross bar. Tighten both front motor mount bolts to 90 foot-pounds.

13. Separate safety chain, remove nut and bolt securing jack adapter plate to transmission case and remove transmission jack.

14. Torque the following bolts as specified:

a. Rear engine mounts to transmission support bar - 55 foot-pounds.

b. Rear engine mounts to transmission (two on right side) - 55 foot-pounds.

c. Transmission to adapter to engine (location "N") - 30 foot-pounds.

d. Transmission to adapter (location "M") - 30 foot-pounds.

CAUTION: The procedure for attaching the converter to the flex plate as described in steps 16 through 18 must be strictly followed. Any deviation from this procedure will result in improper installation and damage to flex plate and transmission.

15. Rotate converter until two of the three weld nuts on converter line up with two of the three bolt holes in flex plate. Position converter so that weld nuts are flush with flex plate, making certain converter is not cocked and that pilot in center of converter is properly seated in crankshaft.

16. Install two flex plate to converter attaching bolts through accessible holes in flex plate and tighten to 28 foot-pounds.

NOTE: Bolts must be tightened at this time to assure proper alignment of converter.

17. Rotate flex plate and converter by rotating bolt previously installed in forward end of crankshaft, until third bolt hole is accessible. Install third bolt, tightening to 28 foot-pounds. Remove bolt from crankshaft and install cork plug.

18. Install vacuum hose on vacuum modulator assembly.

19. Install electrical connector to transmission connector.

20. Position converter cover plate to transmission case and install two lower and one upper right bolts securing cover plate to transmission, tightening to 5 foot-pounds.

21. Position starter to transmission case and install bolt at location "P".

22. Position ground strap to transmission and install bolt securing ground strap and starter motor to transmission at location "O". Tighten bolts at locations "O" and "P" to 25 foot-pounds.

23. Install leads on starter motor.

24. Install bolts at locations "C" and "E" and nut at location "G", securing transmission to final drive.

25. Torque bolts at locations "C" through "F" to 25 foot-pounds.

26. Position acromat to front cross bar and frame horns and install five retaining bolts and washers.

27. Position relay rod to manual yoke and secure with cotter pin.

28. Check operation of manual linkage and adjust, if necessary, as described in Note 22.

29. Disconnect chain fall and lower car.

30. Remove cable from intake manifold and safety chain from transmission.

31. Install bolts at location "A" and "B" and nut at location "H", securing transmission to final drive. Tighten bolts to 25 foot-pounds.

32. Install uper left bolt securing converter cover plate to transmission in the manner described for removing it in step 14.

33. Install bolts at locations "I", "K" and "L", securing transmission to engine and adapter.

34. Torque bolts at locations "I", "J", "K" and "L" to 25 foot-pounds.

35. Tighten brass cooler pipe connectors at case to 28 foot-pounds. Clean ends of cooler pipes with solvent, reposition cooler pipes, and connect pipes to transmission using Oil Cooler Pipe Wrench, J-21477. Tighten fittings to 28 ft. lbs.

36. Connect oil cooler pipes to radiator, using Oil Cooler Pipe Wrench, J-21477. Tighten fittings to 40 foot-pounds.

37. Install cooler pipe clamp.

38. Install speedometer cable to governor.

39. Install new O-ring on transmission filler tube and install filler tube through hole in final drive case.

40. Position transmission filler tube bracket to exhaust manifold and install retaining bolt.

41. Install body ground strap to firewall and secure with nut.

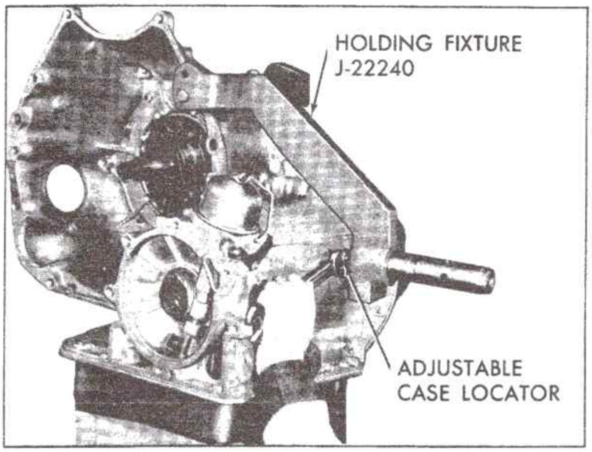


Fig. 7-136 Attaching Holding Fixture to Transmission

42. Connect negative battery cable.

43. Fill transmission with fluid as required, see Note 25.

44. Install hood assembly as described in Section 11, Note 2.

29. Installing Transmission on Holding Fixture

1. With transmission on portable jack, remove Converter Holding Clamp, J-21366, and then remove converter assembly from transmission by pulling converter straight out of housing.

CAUTION: Converter with oil weighs approximately 50 pounds. Be careful not to drop or damage converter when removing it.

If transmission is to be overhauled, place converter on opposite end of workbench from transmission Holding Fixture Base.

2. Position Transmission Holding Fixture, J-22240, to transmission, Fig. 7-136.

3. Attach Holding Fixture, J-22240, to transmission using a 3/8-16 x 2-1/4 inch bolt and nut at location "K". Use special screw provided with Holding Fixture to attach Holding Fixture to rear side of transmission case.

4. Tighten adjustable case locator pivot bolt to boss on side of transmission case.

NOTE: Do not overtorque adjustable case locator nut.

5. Install Transmission Holding Fixture, J-22240, and transmission into Holding Fixture Base, J-3289-01, then install lock pin in base.

6. Remove transmission jack from transmission.

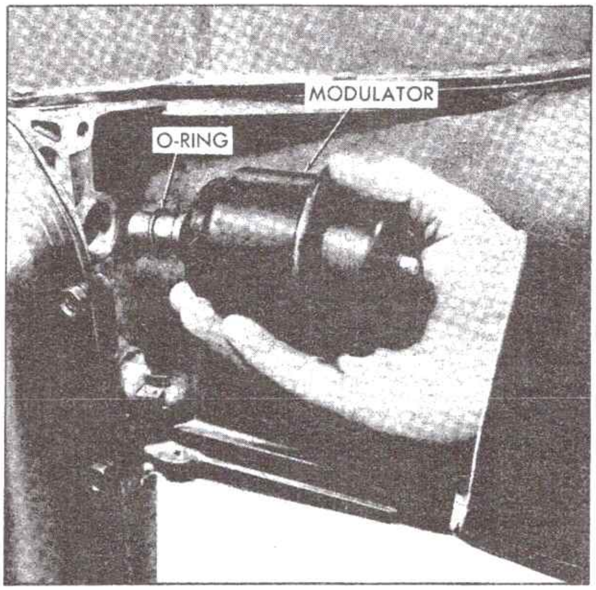


Fig. 7-137 Removing Vacuum Modulator and O-Ring

7. Provide a container to catch any oil that may drain from transmission.

30. Major Transmission Components Removal (Fig. 7-107)

a. Remove Vacuum Modulator and Valve

NOTE: Unit may be removed without removing transmission or bottom pan, after removing vacuum hose.

1. Remove vacuum modulator attaching screw and retainer from transmission case.

2. Remove modulator assembly and O-ring from transmission case. Remove and discard O-ring from vacuum modulator, Fig. 7-137.

3. Remove modulator valve from transmission case, Fig. 7-138.

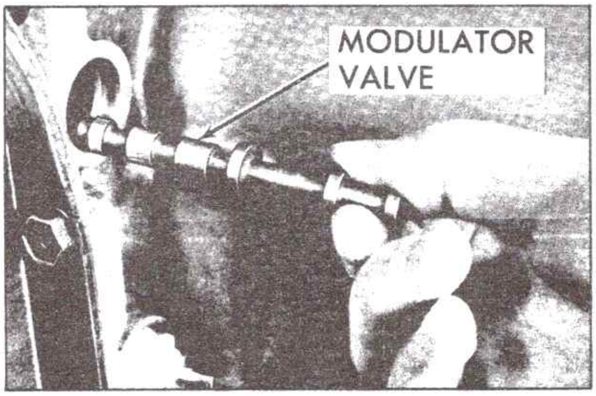


Fig. 7-138 Removing Modulator Valve

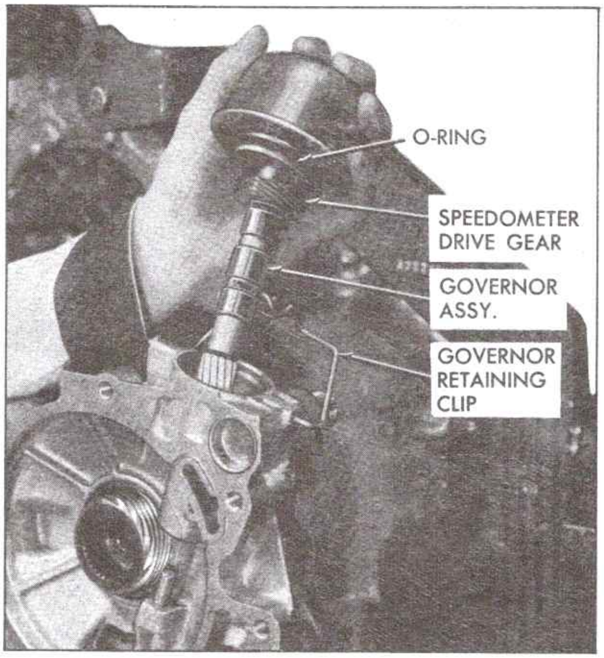


Fig. 7-139 Removing Governor Assembly

NOTE: Modulator bushing is a tight fit in transmission case and should not be removed forcibly unless it is damaged, scored, or otherwise deformed.

b. Remove Governor Assembly

NOTE: Unit may be removed without removing transmission from car.

1. Force top of spring clip downward, releasing governor assembly.

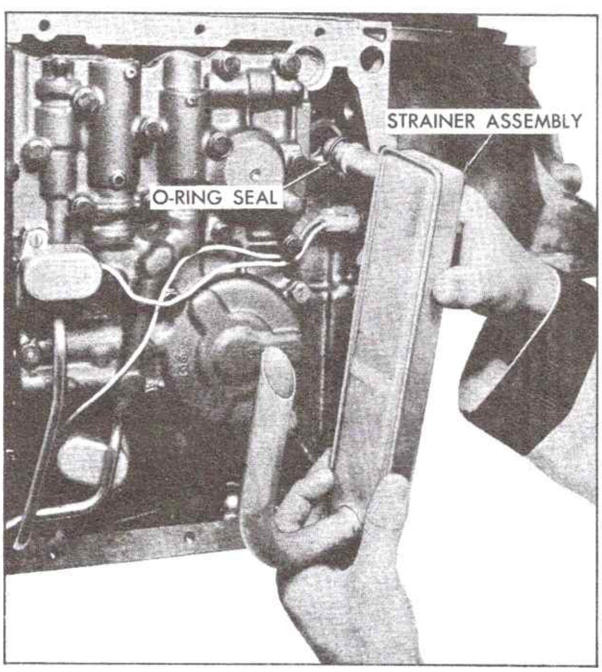


Fig. 7-140 Removing Intake Pipe and Strainer Assembly

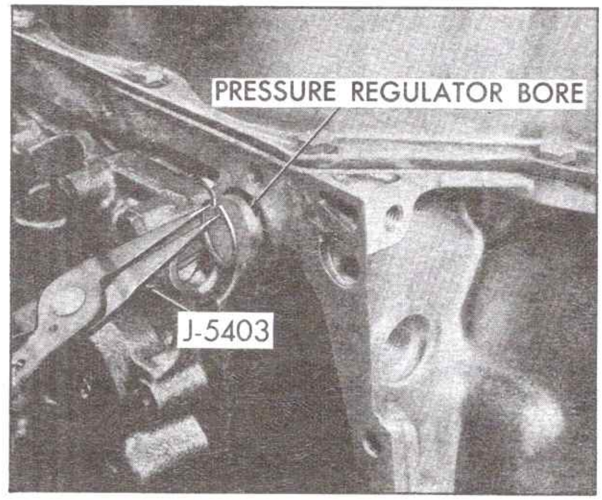


Fig. 7-141 Removing Pressure Regulator Valve

2. Remove governor assembly from case, and remove square-cut O-ring from governor assembly and discard O-ring, Fig. 7-139.

NOTE: The governor assembly, including the driven gear, is not serviceable and must be replaced as an assembly.

c. Remove Speedometer Driven Gear Assembly

NOTE: Unit may be removed without removing transmission from car or without removing governor assembly.

1. Remove attaching screw and retainer from left side of case. Apply slight pressure to remove sleeve and speedometer driven gear.

2. Remove and discard O-ring from speedometer driven gear assembly.

d. Remove Intake Pipe and Strainer Assembly and Bottom Pan

NOTE: Units may be removed with transmission in car. In cases of transmission failure, intake pipe and strainer must be replaced.

1. Rotate transmission and Holding Fixture in Holding Fixture Base so that transmission bottom pan is up. Position container to catch any fluid which may drain from transmission.

2. Remove 13 bottom pan attaching screws.

3. Remove bottom pan and gasket, discarding gasket.

4. Lift out intake pipe and strainer assembly, Fig. 7-140.

5. Remove and discard intake pipe O-ring, Fig. 7-140.

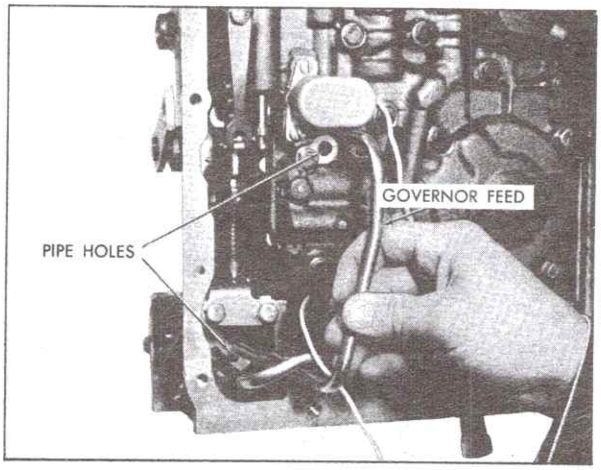


Fig. 7-142 Removing Governor Feed Pipe

e. Remove Pressure Regulator Valve

NOTE: Unit may be removed with transmission in car after removing bottom pan.

1. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-141.

CAUTION: Pressure regulator spring is under extreme pressure.

2. Remove regulator boost valve bushing and valve.

3. Remove pressure regulator spring.

4. Remove regulator valve, spring retainer, and spacer or spacers if present.

f. Remove Control Valve Assembly, Governor Pipes, Detent Spring and Roller Assembly, Stator Solenoid, and Check Balls

NOTE: Units may be removed with transmission in car, after removing bottom pan.

1. Remove attaching screw and remove detent roller and spring assembly.

2. Remove stator connector from case connector and disconnect detent (white) wire from stator connector.

3. Remove governor feed pipe from transmission case and valve body by lifting straight out, Fig. 7-142.

4. Remove twenty remaining control valve assembly attaching screws. Do not remove detent solenoid attaching screws at this time.

5. Remove control valve assembly with remaining governor pipe attached, Fig. 7-143.

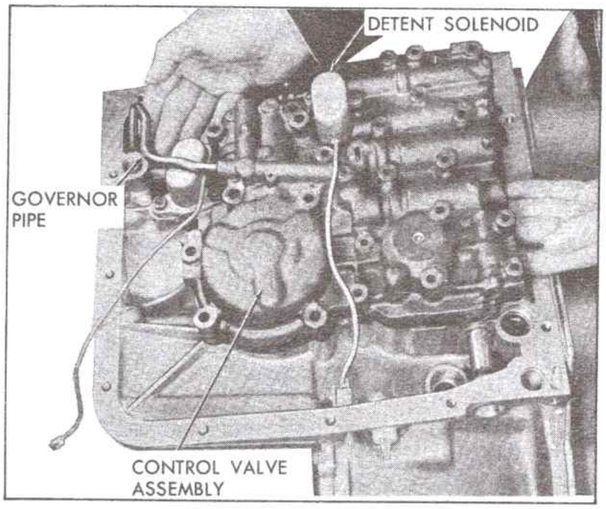


Fig. 7-143 Removing Control Valve Assembly

CAUTION: Do not allow manual valve to fall out of its bore in control valve assembly.

6. Remove remaining governor pipe from valve body.

7. Remove control valve assembly to spacer gasket.

8. Remove two screws attaching stator solenoid to transmission case and remove stator solenoid.

9. Remove control valve spacer and spacer-to-transmission case gasket, Fig. 7-144.

10. Remove seven check balls from cored passages in transmission case.

NOTE: The eighth check ball is held in by a retainer and cannot be removed.

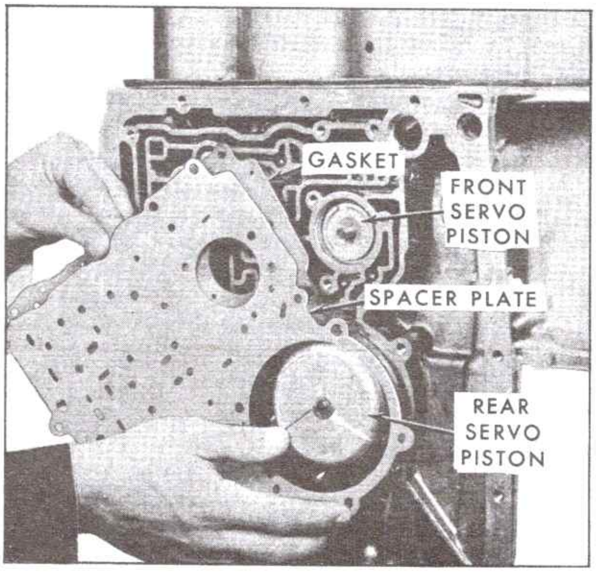


Fig. 7-144 Removing Control Valve Spacer and Gasket

g. Remove Front Servo Piston and Rear Servo Piston

NOTE: Units may be removed with transmission in car after removing bottom pan and control valve assembly.

1. Lift front servo piston, washer, pin, retainer and spring out of transmission case, Fig. 7-144.

2. Remove rear servo assembly from transmission case, Fig. 7-144.

3. Remove rear servo accumulator spring.

4. Make band apply pin selection check to determine proper size pin to use at time rear servo is assembled. Proceed as described in Step h.

h. Band Apply Pin Selection Check (Fig. 7-145)

NOTE: Check may be made with transmission in car. Remove bottom pan, control valve assembly, and rear servo.

1. Position Adapter Plate, J-21370-8, on transmission case over rear servo bore, and, using screws provided with Adapter Plate, attach Band Apply Pin Selector Gage, J-21370 to Adapter Plate.

2. Position Band Apply Pin Selector Gage, J-21370, with hex nut on side of gage facing toward converter housing, and smaller diameter end of Gage Pin, J-21370-7, in servo pin bore.

3. Secure Adapter Plate to transmission case with two 5/16 - 18 x 1 inch screws, tightening screws to 18 foot-pounds and secure Selector Gage to Adapter Plate, tighten attaching screws to 18 foot-pounds. Make certain that stepped gage pin is free to move up and down in both tool and servo pin bore. Stepped side of pin must face rear of transmission case.

Band apply pins are available in three sizes as shown in the following chart:

Identification	Length
Three Rings	Long
Two Rings	Medium
One Ring	Short

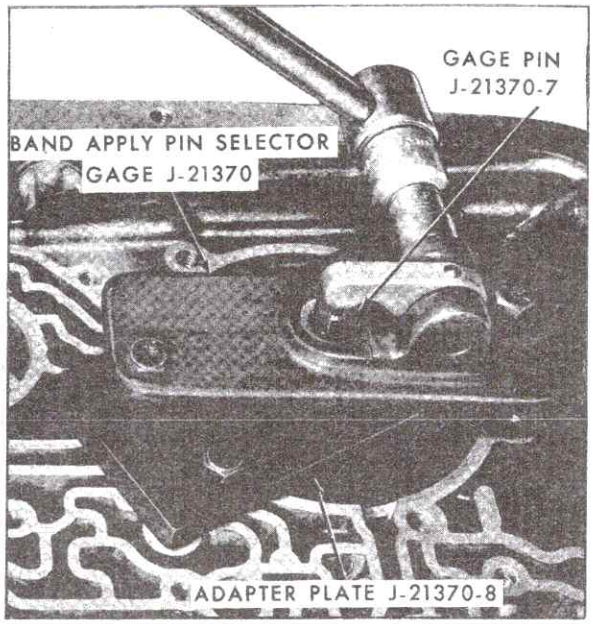


Fig. 7-145 Band Apply Pin Selection Check

Identification ring is located on band lug end of pin. Selecting the proper pin is equivalent to adjusting band.

4. To determine proper size pin to use, apply 25 foot-pounds torque on hex nut on side of gage. This will cause lever on top of gage to depress stepped gage pin into servo pin bore, simulating actual operating conditions. Note relation of steps on gage pin and machined surface on top of gage. Determine proper size pin as follows:

a. If machined surface on top of gage is even with or above upper step on gage pin, long size pin (three rings) is required.

b. If machined surface on top of gage is between upper and lower steps on gage pin, medium size pin (two rings) is required.

c. If machined surface on top of gage is even with or below lower step on gage pin, short size pin (one ring) is required.

5. If new pin is required, make note of pin size required, and remove gage from transmission case.

i. Remove Detent Lever, Manual Shaft, and Parking Linkage (Fig. 7-146)

NOTE: Units may be removed with transmission in car after removing bottom pan and detent roller and spring assembly from control valve assembly.

1. Remove pin securing manual shaft to case by pulling straight out.

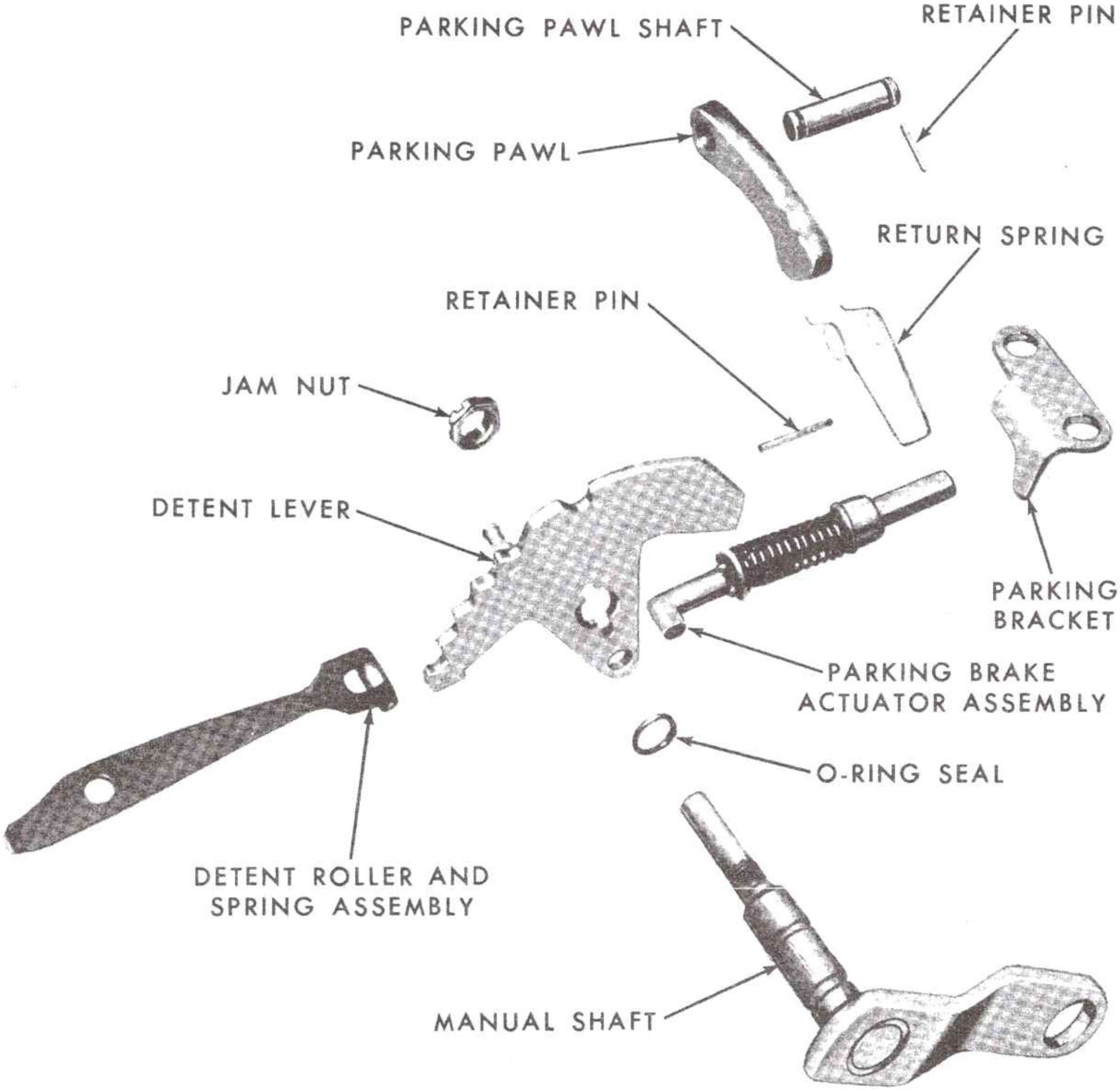


Fig. 7-146 Manual and Parking Linkage Disassembled

2. Loosen locknut securing detent lever to manual shaft.

3. Pry or work detent lever loose from ground flats on manual shaft.

4. Remove manual shaft from case bore and remove and discard O-ring seal from manual shaft.

NOTE: Be careful not to drop jam nut inside of case.

5. Remove detent lever and parking brake actuator assembly from case and remove actuator assembly from detent lever.

6. Remove parking brake bracket attaching screws and remove bracket.

7. Remove retainer pin securing parking pawl shaft to transmission case by pulling straight out.

8. Remove parking pawl shaft, parking pawl and return spring.

j. Remove Sprocket Cover, Link Assembly, Drive and Driven Sprockets

1. Rotate transmission in holding fixture base so that sprocket cover is up and remove eighteen cover attaching screws.

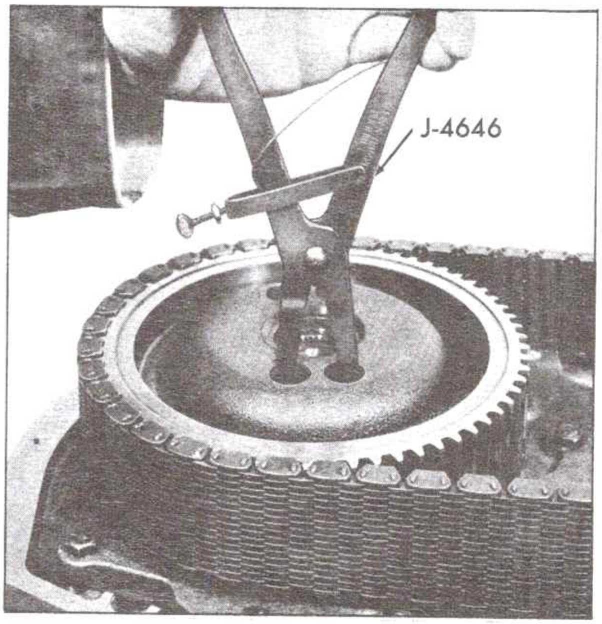


Fig. 7-147 Removing Sprocket Snap Ring

2. Remove cover and gasket and discard gasket.

3. Install Snap Ring Pliers, J-4646, into sprocket bearing retaining snap rings located under the drive and driven sprockets, and remove snap rings from retaining grooves on support housings. Fig. 7-147

NOTE: Leave snap rings in a loose position between sprockets and bearing assemblies.

4. Remove drive and driven sprockets, link assembly, bearings, and shafts simultaneously by alternately pulling upwards on the drive and driven sprockets until the bearings are out of the drive and driven support housings, Fig. 7-148.

NOTE: If the sprockets are difficult to remove, place a small piece of masonite, or similar material between the sprocket and sprocket support cover. Using a 1/2 x 9 inch pry bar, alternately pry upward under each sprocket on sprocket support cover. Do not pry on the guide links or the aluminum case. Pry only on the sprockets, Fig. 7-149.

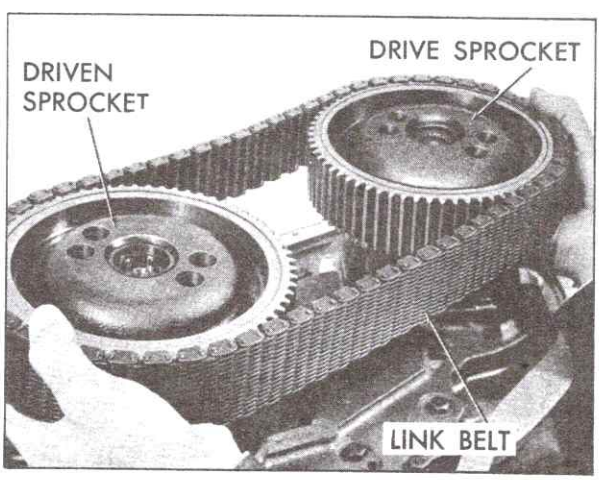


Fig. 7-148 Removing Sprockets and Link Assembly

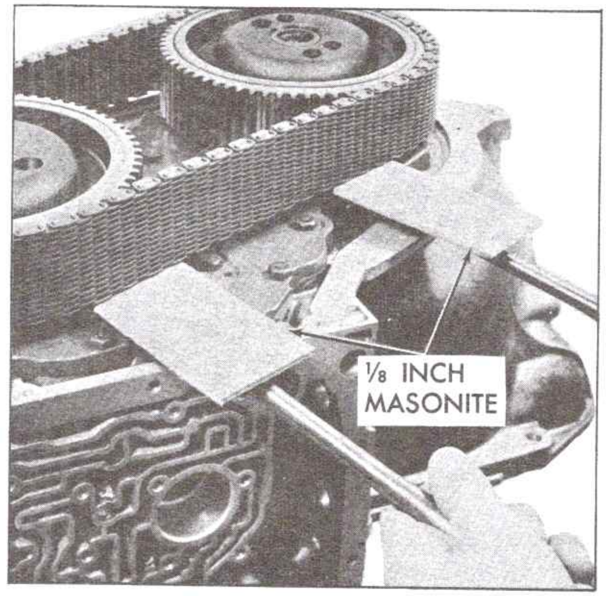


Fig. 7-149 Removing Tight Sprockets

5. Remove link assembly from drive and driven sprockets.

6. Remove two hook type oil seal rings from turbine shaft.

7. Inspect drive and driven sprocket bearing assemblies for rough or defective bearings.

NOTE: Do not remove bearing assemblies from drive and driven sprockets unless they need replacement.

8. If removal of bearing assembly from drive and/or driven sprockets is necessary, proceed as follows:

a. Remove sprocket to bearing assembly retaining snap ring using Snap Ring Pliers, J-8059, Fig. 7-150.

b. Mount sprocket, with turbine or input shaft placed down between two 2" x 4" x 10" wood blocks.

NOTE: Wood blocks are positioned on sides or ends, depending on which bearing is to be replaced.

c. With a hammer and brass rod, drive the inner race, alternately through each of the access openings, until the bearing assembly is removed from the sprocket hub. (Fig. 7-151)

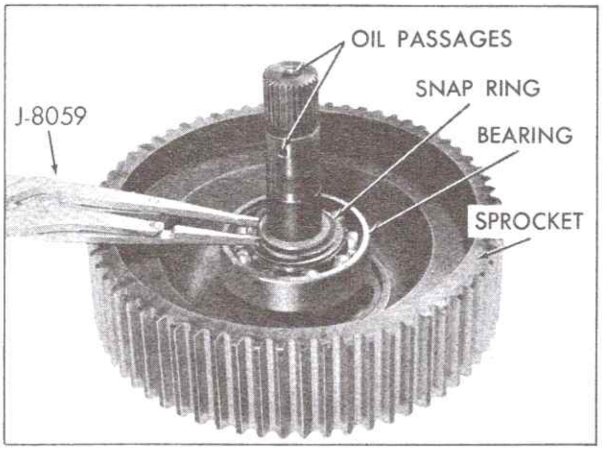


Fig. 7-150 Removing Sprocket Bearing Snap Ring

k. Inspect Drive Sprocket and Turbine Shaft, and Link Assembly

1. Inspect drive sprocket teeth for nicks, burrs, scoring, galling, and excessive wear.

NOTE: Wear pattern at bottom of tooth form is normal.

2. Inspect drive sprocket to ball bearing retaining snap ring for damage.

3. Inspect drive sprocket ball bearing inner race mounting surface for damage.

4. Inspect turbine shaft for open lubrication passages. Run a tag wire through the passages to be sure they are open. See lubrication chart for passage location, Fig. 7-128.

5. Inspect spline for damage.

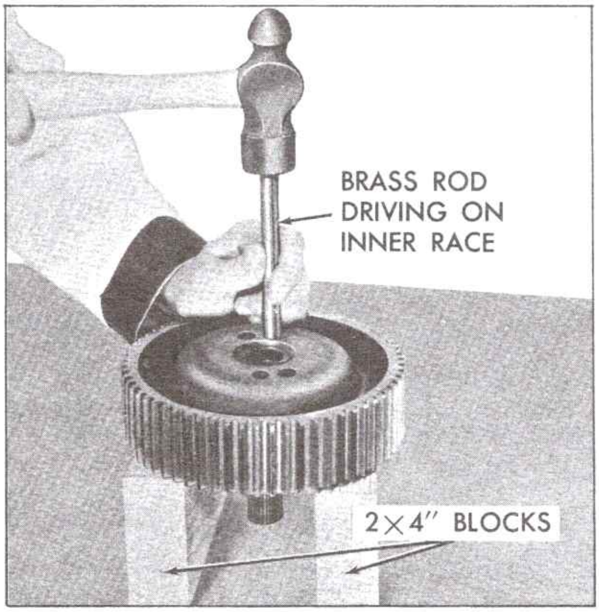


Fig. 7-151 Removing Sprocket Bearing Assembly

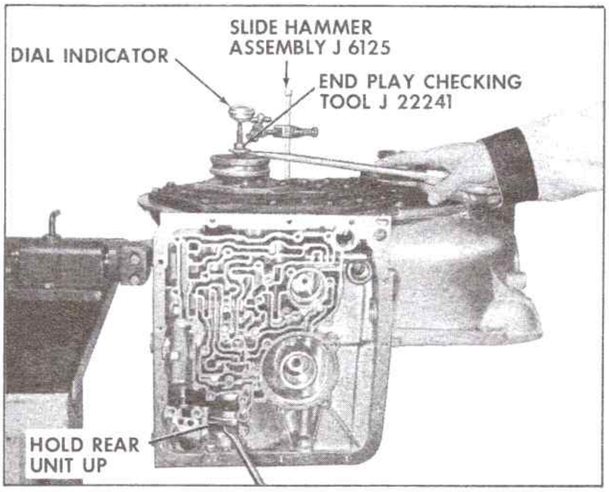


Fig. 7-152 Checking Front Unit End Play

6. Inspect the ground bushing journals for damage.

7. Inspect the two hook type oil seal grooves for damage or excessive wear.

8. Inspect the turbine shaft for cracks or distortion.

9. Inspect the link assembly for damage or loose links.

NOTE: Check the guide links. Guide links are the wide outside links on each side of the link assembly.

l. Inspect Driven Sprocket and Input Shaft

1. Inspect driven sprocket teeth for nicks, burrs, scoring, galling, and excessive wear.

NOTE: Wear pattern at bottom of tooth form is normal.

2. Inspect sprocket to ball bearing retaining snap ring for damage.

3. Inspect ball bearing inner race mounting surface for damage.

4. Inspect input shaft for open lubrication holes. Run a tag wire through the holes to be sure they are open. See lubrication chart, Fig. 7-128, for location of holes.

5. Inspect spline for damage.

6. Inspect ground bushing journal for damage.

m. Install Sprocket Bearings

1. Turn sprocket so that turbine or input shaft is pointing upward.

2. Install new sprocket bearing as follows:

a. Install support snap ring, letter side down, onto shaft.

b. Assemble bearing assembly on turbine or input shaft.

c. Using a piece of pipe, drive the bearing assembly onto the hub of the sprocket until it is resting on the bearing seat of the sprocket.

CAUTION: Use pipe that closely fits I.D. of bearing assembly but does not contact shaft.

d. Install sprocket to bearing assembly retaining snap ring into groove in sprocket hub.

3. Install two hook type oil seal rings on turbine shaft.

NOTE: Turbine and/or input shaft may appear not to be pressed fully into the sprocket. Do not attempt pressing shaft further as a specific length dimension is held during initial assembly.

n. Front Unit End Play Check

1. Install Front Unit End Play Checking Tool, J-22241, into driven sprocket housing so that the urethane on the tool can engage the splines in the forward clutch housing. Let the tool bottom on the mainshaft and then withdraw it approximately 1/8 inch and tighten nut on tool, Fig. 7-152.

2. Remove one bolt from the driven support housing, and install slide hammer bolt, J-6125-1, into bolt hole in driven support housing.

NOTE: Do not thread slide hammer bolt deep enough to interfere with forward clutch housing travel.

3. Mount Dial Indicator, J-8001, on Slide Hammer Bolt and index Indicator to register with the Front Unit End Play Checking Tool, J-22241, Fig. 7-152 and push Tool down to remove slack.

4. Push and hold output flange upward. Place a screw driver in case opening at parking pawl area and push upward on output carrier.

5. Place another screw driver between the metal lip of the End Play Tool and the driven sprocket housing and push upward on the metal lip of the End Play Tool and read the resulting end play, which should be between .003" and .024".

The selective washer controlling this end play is the phenolic thrust washer located between the driven support housing and the forward clutch housing. If more or less washer thickness is required to bring the end play within specifications, select the proper washer from the chart below:

THICKNESS	COLOR
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

NOTE: An oil soaked washer may tend to discolor so that it will be necessary to measure the washer with a set of one inch micrometers to determine its actual thickness.

6. Remove End Play Tool from transmission and remove Dial Indicator and Slide Hammer Bolt from transmission.

o. Remove Oil Pump

1. Remove two opposite pump attaching bolts from the drive support housing.

2. Install two 5/16-18 x 4" guide pins in holes from previously removed bolts.

3. Remove the remaining pump attaching bolts from the drive support housing.

4. With one hand hold the under side of the pump and gently tap the guide pins until the pump is removed from the case.

p. Remove Pump Cover Plate and Drive and Driven Support Housing Assemblies

1. Remove the twenty-three pump cover plate to case attaching screws. Do not remove sprocket support housing bolts at this time.

2. Remove pump cover plate and plate to case face gasket. Discard gasket.

NOTE: Drive and driven support housing assemblies are pressed into and removed with the pump cover plate. Do not remove them unless it is necessary.

3. Remove two hook type oil seal rings from the driven support housing.

4. Remove the front unit end play selective phenolic thrust washer from the hub of the driven support housing.

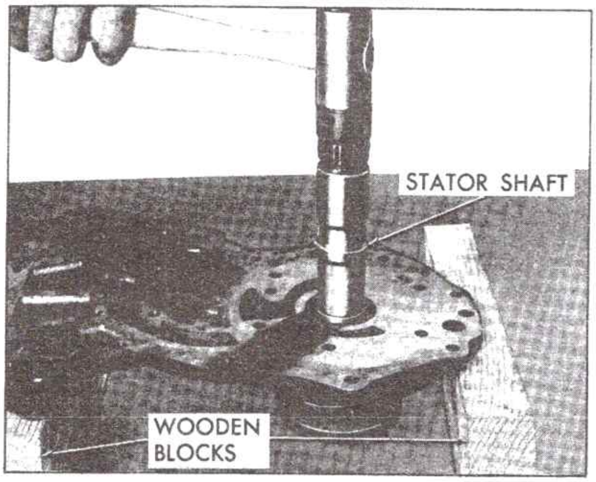


Fig. 7-153 Removing Drive Sprocket Support

5. If necessary to remove the drive and driven sprocket support housing assemblies, proceed as follows:

a. Remove the remaining sprocket support to pump cover plate attaching bolts.

b. Support cover plate on wooden blocks and using a plastic mallet, vigorously strike the stator shaft of the drive sprocket support, Fig. 7-153, and the hub of the driven sprocket support, Fig. 7-154, until they are removed from their pump cover plate bores.

NOTE: When driving the housings out of the pump cover plate avoid damaging or distorting the stator shaft or the ring grooves in the hub of the driven housing.

c. Remove and discard housing to pump cover plate gaskets.

d. Remove and inspect converter out check valve from pump cover.

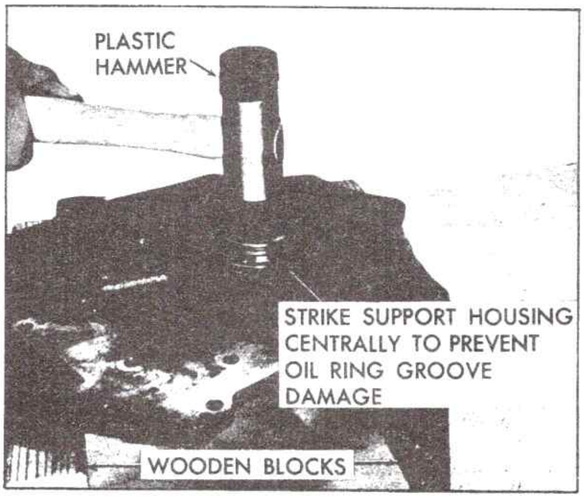


Fig. 7-154 Removing Driven Sprocket Support

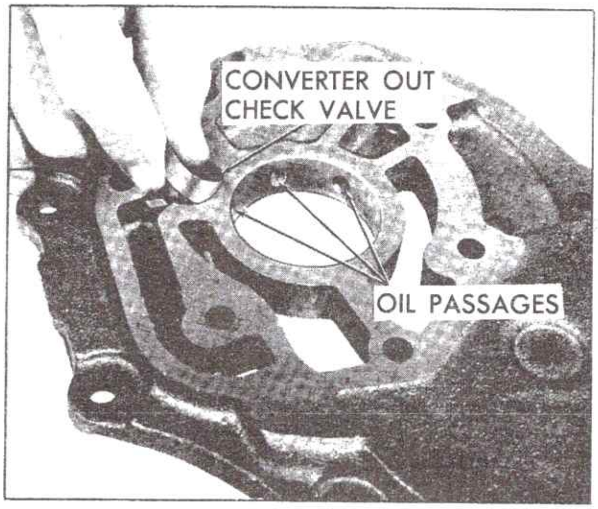


Fig. 7-155 Installing Converter Out Check Valve

e. Install converter out check valve in drive sprocket support housing, Fig. 7-155.

f. Install drive sprocket support housing to pump cover plate gasket.

g. Install drive sprocket support housing into pump cover plate by using a plastic mallet to seat the housing. Use bolts for guides, Fig. 7-156.

h. Install driven sprocket support housing to pump cover plate gasket.

i. Install driven sprocket support housing to pump cover plate attaching bolts for gasket guides.

j. Install driven sprocket support housing into pump cover plate by using a plastic mallet to seat the housing.

k. Install all but one driven support housing to pump cover plate attaching bolts. Torque to 20 ft. lbs.

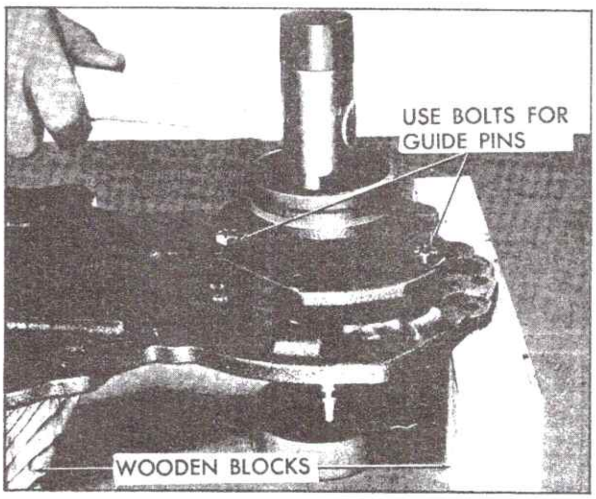


Fig. 7-156 Installing Driven Sprocket Support

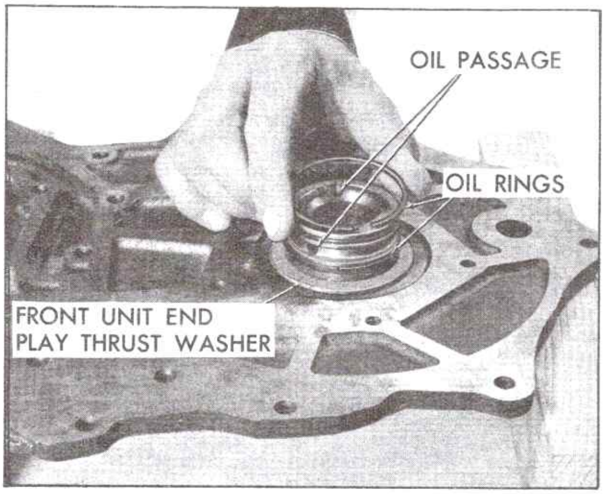


Fig. 7-157 Installing Oil Rings on Driven Sprocket Support

6. Install proper front unit end play phenolic selective thrust washer on the hub of the driven sprocket support housing. Use micrometer to determine the actual thickness of the phenolic thrust washer.

7. Install two hook type oil seal rings into the grooves in the hub of the driven sprocket support housing, Fig. 7-157.

q. Remove Forward Clutch Assembly, Direct Clutch Assembly, Sun Gear Shaft, and Front Band

1. Remove forward clutch assembly from transmission, Fig. 7-158, by installing Front End Play Checking Tool, J-22241, into forward clutch and lifting forward clutch straight out.

2. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch assembly.

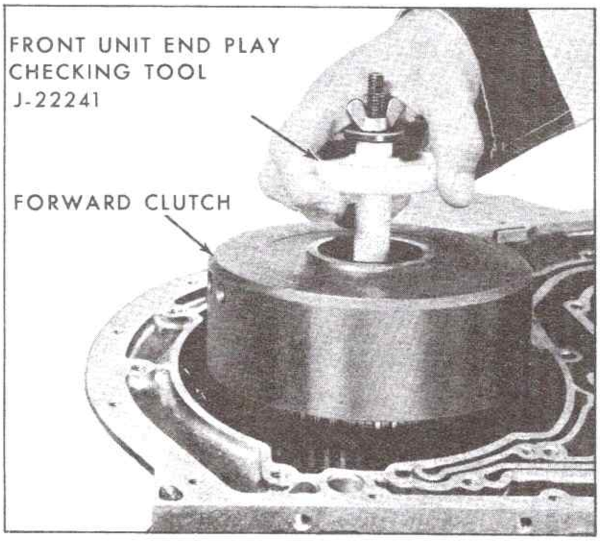


Fig. 7-158 Removing Forward Clutch

3. Remove direct clutch and intermediate sprag assembly by lifting straight out. Sun gear shaft may come out with direct clutch assembly.

4. Remove sun gear shaft if not previously removed.

5. Remove front band assembly.

NOTE: Check rear unit end play at this time. Proceed as described in Step r.

r. Rear Unit End Play Checking Procedure

1. Rotate transmission in holding fixture base so that forward end of transmission is up.

2. Install Speedometer Puller bolt, J-21797, in one of the differential mounting bolt holes on end of transmission case.

3. Mount Dial Indicator, J-8001, on Bolt J-21797, and index indicator to register with flat surface on end of output flange, Fig. 7-159.

4. Set dial indicator to zero.

5. Using a screw driver, move output shaft in and out. Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .003 inch - .019 inch.

The selective washer controlling this end play is the steel washer with the three tabs, located between thrust washer and rear face of transmission case. Notches on the tabs serve to identify washer thickness.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart.

THICKNESS	IDENTIFICATION NOTCH
.078-.082	None
.086-.090	On Side of 1 Tab
.094-.098	On Side of 2 Tabs
.102-.106	On End of 1 Tab
.110-.114	On End of 2 Tabs
.118-.122	On End of 3 Tabs

6. Remove Dial Indicator, J-8001, and Bolt, J-21797, from transmission and rotate transmission so that rear end of transmission is up.

s. Remove Remaining Components

1. Remove center support bolt from transmission case, Fig. 7-160, using a 3/8 inch 12-point thin wall socket such as Snap-On SFH 121.

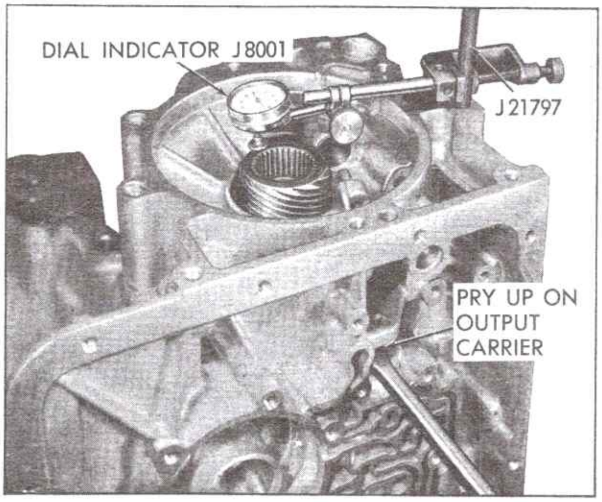


Fig. 7-159 Checking Rear Unit End Play

2. Remove intermediate clutch backing plate to case snap ring.

3. Remove intermediate clutch backing plate, and three composition and three steel clutch plates.

4. Using a needle-nose pliers, or screwdriver, remove center support to case snap ring.

5. Install Gear Assembly Remover and Installer Adapter, J-21795, on end of main shaft so that tangs engage groove in shaft. Using Slide Hammer Handle, J-6125, and Speedometer Puller Bolt, J-21797, tighten bolt on Tool to secure Tool on shaft and prevent movement of roller clutch during removal of gear unit assembly, Fig. 7-161.

6. Remove complete gear unit assembly from case, by lifting straight up.

CAUTION: Be careful not to drop or bump assembly in transmission case during removal.

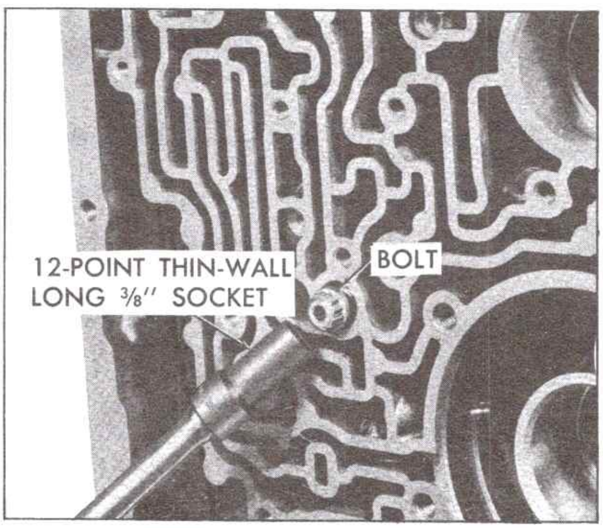


Fig. 7-160 Removing Center Support Bolt

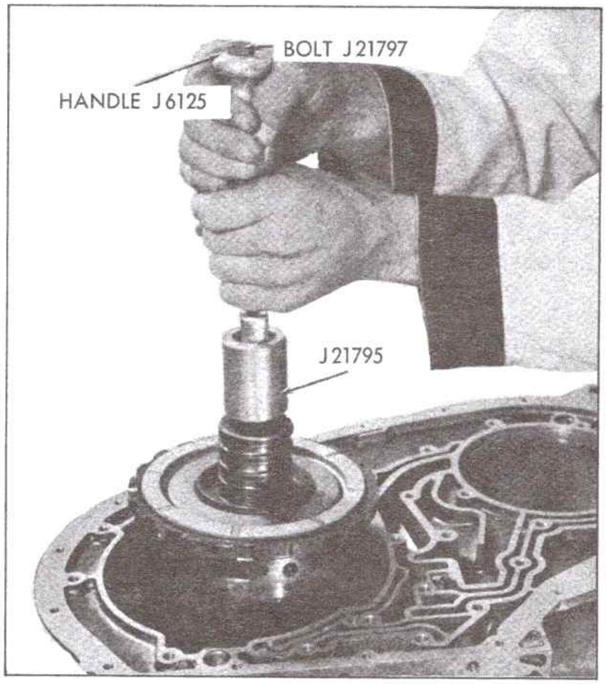


Fig. 7-161 Removing Gear Unit Assembly

7. Remove output flange to case thrust washer from output shaft or case.

8. Place gear unit assembly on bench with output flange down. Remove Tool J-21795.

9. Remove center support to reaction carrier thrust washer.

NOTE: Thrust washer may have stuck to back of center support. If so, remove from center support.

10. Remove rear unit selective washer from transmission case.

11. Remove rear band assembly. To facilitate removal, rotate band lugs away from pins and pull band assembly out of transmission case.

31. Individual Unit Disassembly, Cleaning, Inspection, Assembly and Installation of Major Components

a. Inspection of Transmission Case

1. Inspect case assembly for cracks, porosity or interconnected passages.

2. Check for good retention of band anchor pins.

3. Inspect all threaded holes for thread damage.

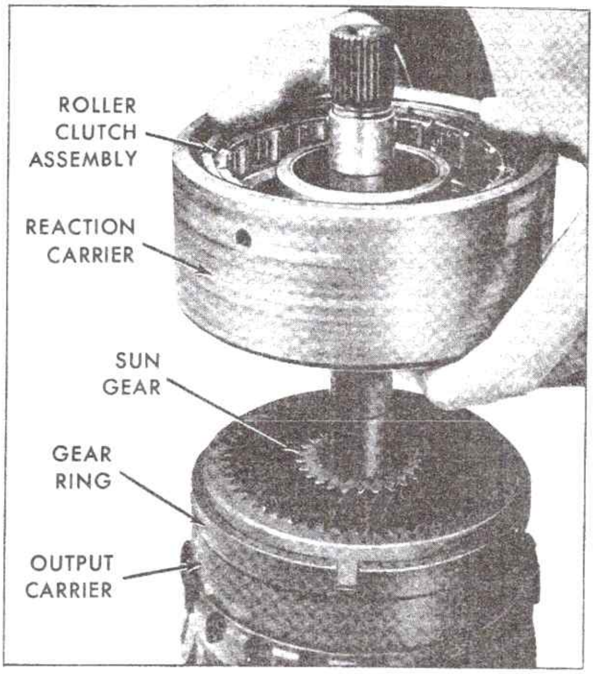


Fig. 7-162 Removing Reaction Carrier and Roller Clutch Assembly

4. Inspect intermediate clutch driven plate lugs for damage or brinelling.

5. Inspect snap ring grooves for damage.

6. Inspect governor assembly bore for scratches or scoring.

7. Inspect governor pipes screen assemblies for plugging or damage.

8. Inspect modulator valve bore for scoring or damage.

b. Center Support and Gear Unit

1. Disassembly

a. Remove center support assembly from reaction carrier by lifting center support straight up.

b. Remove reaction carrier and roller clutch assembly from output carrier, Fig. 7-162, and remove roller clutch assembly from reaction carrier.

c. Remove center support to sun gear races and thrust bearing from sun gear.

NOTE: One of the races may have stuck to back of center support.

d. Remove sun gear from output carrier assembly.

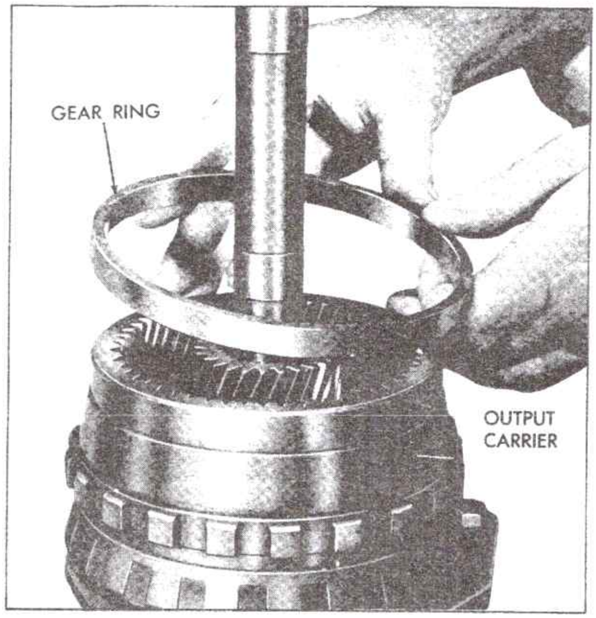


Fig. 7-163 Removing Front Internal Gear Ring

e. Remove reaction carrier to output carrier plastic thrust washer from output carrier.

f. Remove front internal gear ring from output carrier assembly, Fig. 7-163.

g. Invert gear unit and place in Rear Unit Holding Fixture, J-6116, with main shaft pointing downward.

h. Remove snap ring securing output flange to output carrier and remove output flange.

i. Remove thrust bearing and races from rear internal gear.

j. Lift rear internal gear and main shaft out of output carrier and remove thrust bearing and races from inner face of rear internal gear.

k. Remove snap ring from end of main shaft and remove rear internal gear.

l. Remove output carrier from Holding Fixture.

2. Inspect Output Flange

a. Inspect case bushing for wear or galling.

b. Inspect bearing and thrust washer surfaces for damage.

c. Inspect drive lugs for damage.

d. Inspect splines for damage.

e. Inspect lubrication passages.

3. Inspect Main Shaft

a. Inspect shaft for cracks or distortion.

b. Inspect splines for damage.

c. Inspect ground bushing journals for damage.

d. Inspect snap ring groove for damage.

e. Inspect orificed cup plug in end of main shaft. Be sure it is not plugged.

4. Inspect Rear Internal Gear

a. Inspect gear teeth for damage or wear.

b. Inspect splines for damage.

c. Inspect gear for cracks.

5. Inspect Output Carrier

a. Inspect front internal gear for damaged teeth.

b. Inspect pinion gears for damage, rough bearings or excessive tilt.

c. Check pinion end play. Pinion end play should be .009 inch - .024 inch, Fig. 7-164.

d. Inspect parking gear lugs for cracks or damage.

e. Inspect output shaft locating splines for damage.

f. Inspect front internal gear ring for flaking or cracks.

6. Inspect Reaction Carrier

a. Inspect band surface on reaction carrier for signs of burning or scoring.

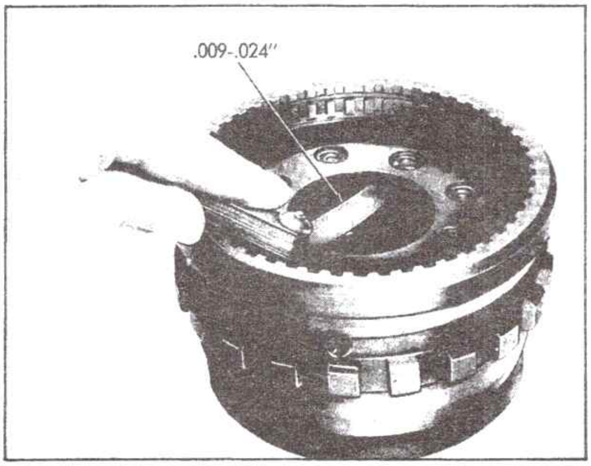


Fig. 7-164 Checking Pinion End Play

b. Inspect roller clutch outer cam for scoring or wear.

c. Inspect thrust washer surfaces for signs of scoring or wear.

d. Inspect bushing for damage. If bushing is damaged, carrier must be replaced.

e. Inspect pinion gears for damage, rough bearings or excessive tilt.

f. Check pinion end play. Pinion end play should be .009 inch - .024 inch.

7. Pinion Gear Replacement - Reaction and Output Carrier Assemblies

a. Support carrier assembly on its FRONT face.

b. Using a tapered punch, drive or press pinion pins out of carrier.

c. Remove pinion gears, thrust washers, and roller needle bearings.

d. Inspect pinion pocket thrust faces for burrs and remove if present.

e. Install nineteen needle bearings into each pinion gear using petrolatum to hold bearings in place. Use a pinion pin as a guide.

f. Place a bronze and steel thrust washer on each side of pinion gear with steel washers against gear, Fig. 7-165. Hold washers in place with petrolatum.

g. Place pinion gear assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.

h. Drive a new pinion pin into place from the front, while rotating pinion gear. Be sure that headed end is flush or below face of carrier.

i. Using a punch in bench vise for an anvil, stake opposite end of pinion pin in three places with a blunt radius chisel, Fig. 7-166.

NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.

j. Repeat installation procedure for each pinion gear.

8. Inspect Roller Clutch

a. Inspect roller clutch for damaged rollers or springs.

b. Inspect roller clutch cage for damage.

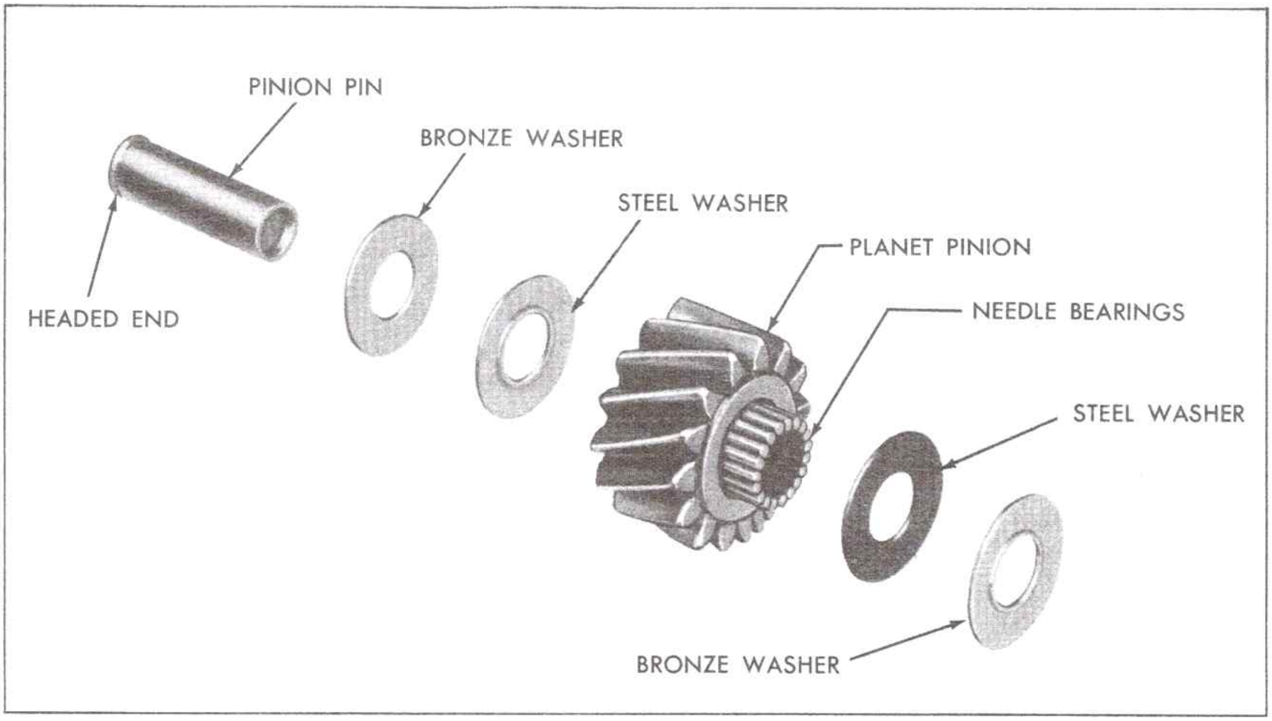


Fig. 7-165 Planet Pinion Assembly Disassembled

9. Inspect Sun Gear

a. Inspect gear teeth for damage or wear.

b. Inspect splines for damage.

c. Be sure oil lubrication hole is open.

10. Inspect Sun Gear Shaft

a. Inspect shaft for cracks or splits.

Fig. 7-166 Staking Pinion Pin

b. Inspect splines for damage.

c. Inspect bushings for scoring or galling.

d. Inspect ground bushing journals for damage.

e. Be sure oil lubrication hole is open.

11. Assemble Gear Unit (Fig. 7-167)

a. Install rear internal gear on end of main shaft that has snap ring groove and install snap ring.

b. Install races and thrust bearing on inner face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:

1. Install large diameter race first, with flange facing up, Fig. 7-168.

2. Install thrust bearing in race.

3. Install small diameter race on bearing with inner flange facing down.

c. Lubricate pinion gears in output carrier with transmission fluid and install output carrier on main shaft so that pinion gears mesh with rear internal gear.

d. Place assembly in Rear Unit Holding Fixture, J-6116, with main shaft pointing downward. Be careful not to damage shaft.

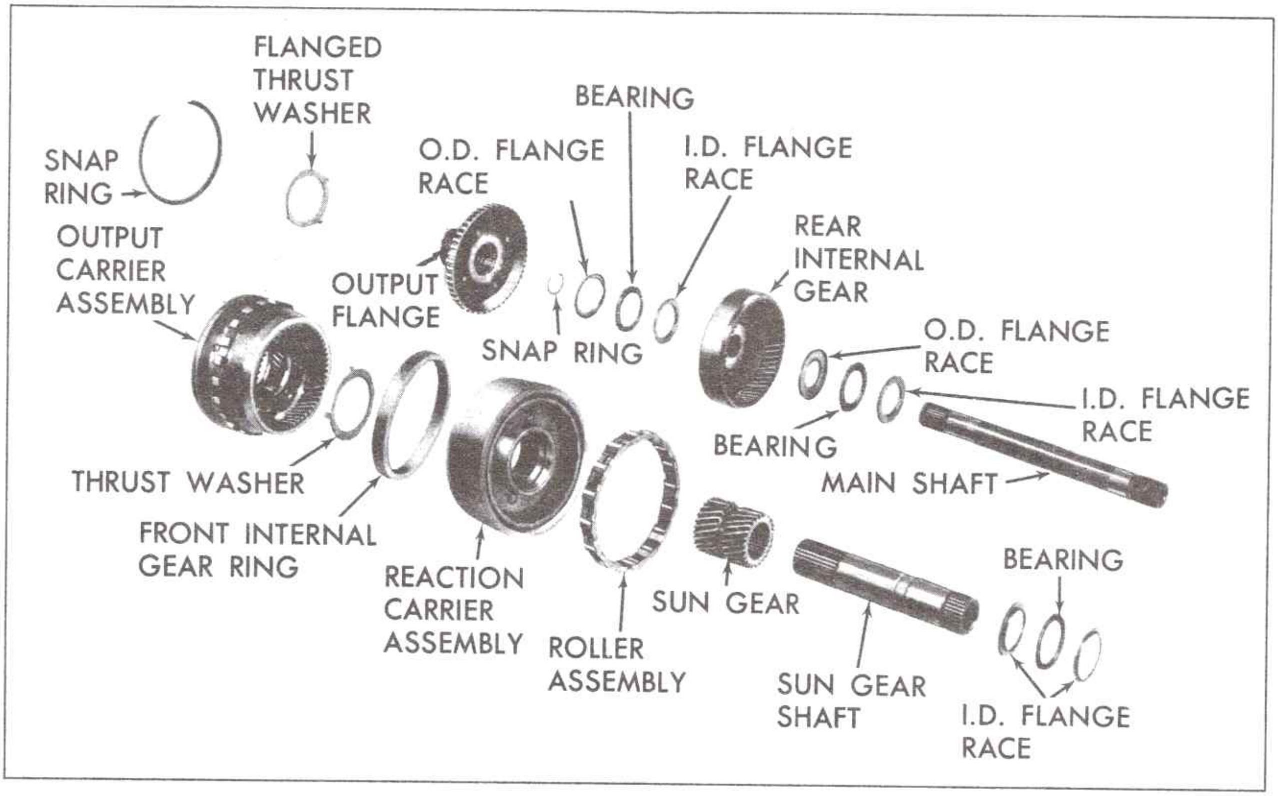


Fig. 7-167 Gear Unit Assembly Disassembled

e. Install races and thrust bearing on outer face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:

1. Install small diameter (flanged I.D.) race first, with flange facing up, Fig. 7-169.

2. Install thrust bearing in race.

3. Install large diameter (flanged O.D.) race on bearing with flange cupped over bearing.

f. Install output shaft into output carrier and install snap ring with bevel edge up.

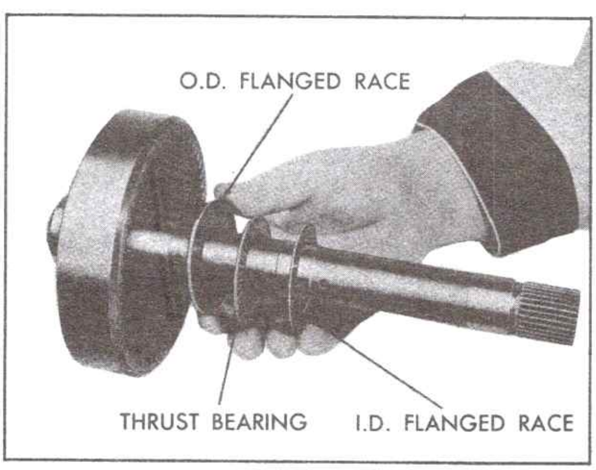


Fig. 7-168 Installing Races and Thrust Bearing on Inner Face of Rear Internal Gear

g. Invert assembly and place on bench with output flange downward.

h. Lubricate tab side of thrust washer with

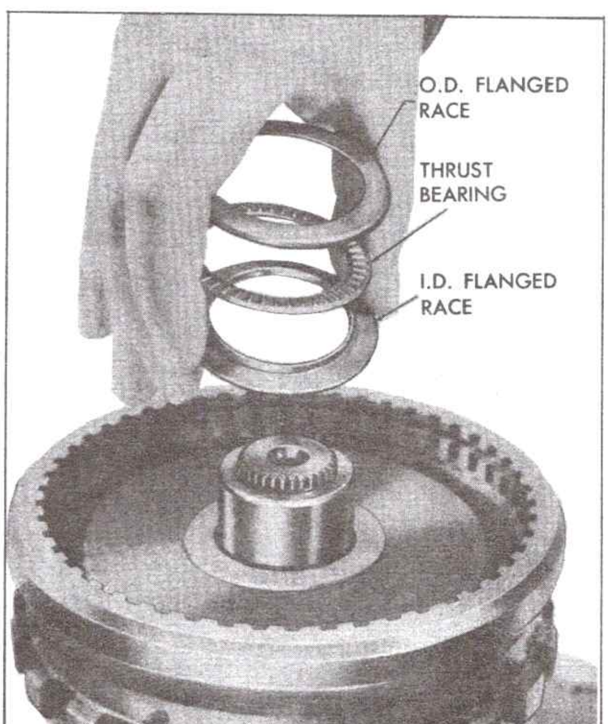


Fig. 7-169 Installing Races and Thrust Bearing on Outer Face of Rear Internal Gear

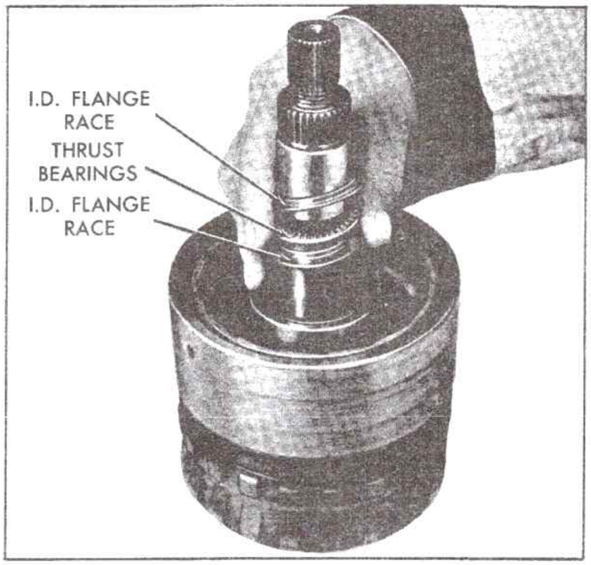


Fig. 7-170 Installing Races and Thrust Bearing over Sun Gear Shaft

petrolatum and install thrust washer in output carrier with bent tabs in tab pockets.

i. Install sun gear with end having chamfered I.D. facing down.

j. Install sun gear shaft with longer splined end down.

k. Install gear ring over output carrier.

l. Lubricate pinion gears in reaction carrier with transmission fluid and install reaction carrier on output carrier so that pinion gears mesh with front internal gear.

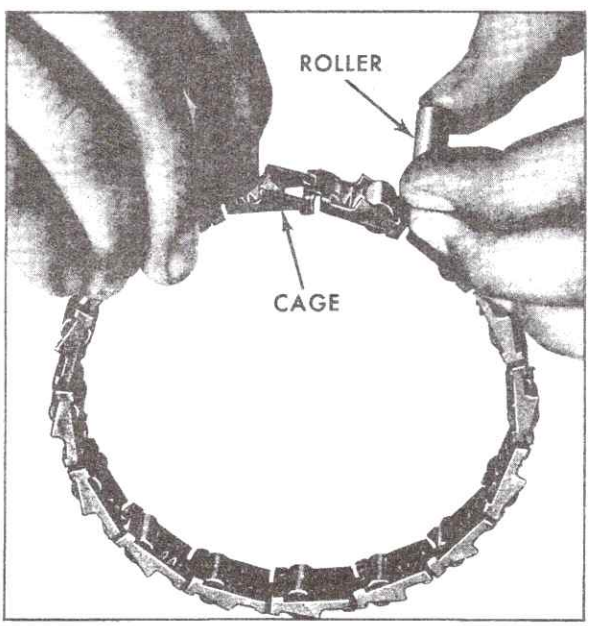


Fig. 7-171 Installing Roller in Roller Clutch Cage

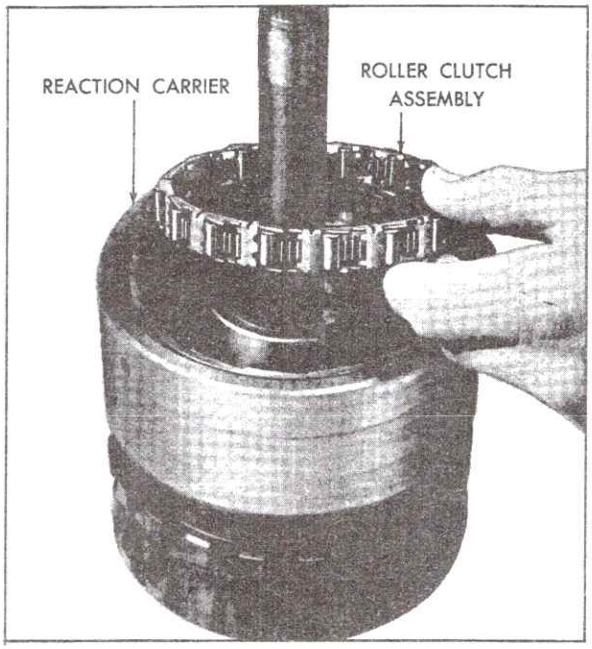


Fig. 7-172 Installing Roller Clutch Assembly in Reaction Carrier

m. Install large diameter O.D. race on sun gear with flange facing up against sun gear shaft.

n. Install thrust bearing on race.

o. Lubricate small diameter race with petrolatum and install race on center support with flange facing up, Fig. 7-170.

p. Install rollers that may have come out of roller clutch cage, by compressing energizing spring with forefinger and inserting roller from outer side, Fig. 7-171.

NOTE: Make certain that energizing springs are not distorted, and that curved end leaf of springs are positioned against rollers.

q. Install roller clutch assembly in reaction carrier, Fig. 7-172.

r. Position gear unit out of way on work bench.

12. Disassemble Center Support and Intermediate Clutch Piston

a. Remove center support to reaction carrier phenolic thrust washer from recess in center support.

b. Remove four hook type oil seal rings from center support.

c. Using Clutch Spring Compressor, J-4670, and Rear Clutch Spring Compressor, J-6129, Fig. 7-173, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.

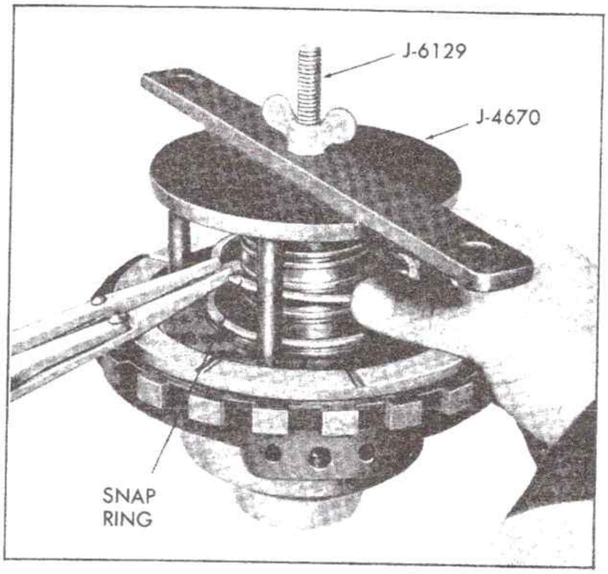


Fig. 7-173 Removing and Installing Intermediate Clutch Piston Snap Rings

d. Remove tools, spring retainer, and twelve intermediate clutch release springs.

e. Remove intermediate clutch piston from center support.

f. Remove inner and outer seals from clutch piston.

NOTE: Do not remove the three screws retaining roller clutch inner race to center support.

13. Inspect Center Support

a. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.

b. Inspect bushing for scoring, wear or galling.

c. Check oil ring grooves for damage.

d. Air check oil passages to be sure they are open and not interconnected.

e. Inspect piston sealing surfaces for scratches.

f. Inspect piston seal grooves for nicks or other damage.

g. Inspect piston for cracks or porosity.

h. Inspect springs for collapsed coils or signs of distortion.

14. Assemble Case Center Support and Intermediate Clutch Piston Assembly (Fig. 7-174.)

a. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in intermediate clutch piston and install seals with lips facing away from spring pockets.

b. Place Intermediate Clutch Inner Seal Protector, J-21363, over center support hub, Fig. 7-175, and install intermediate clutch piston.

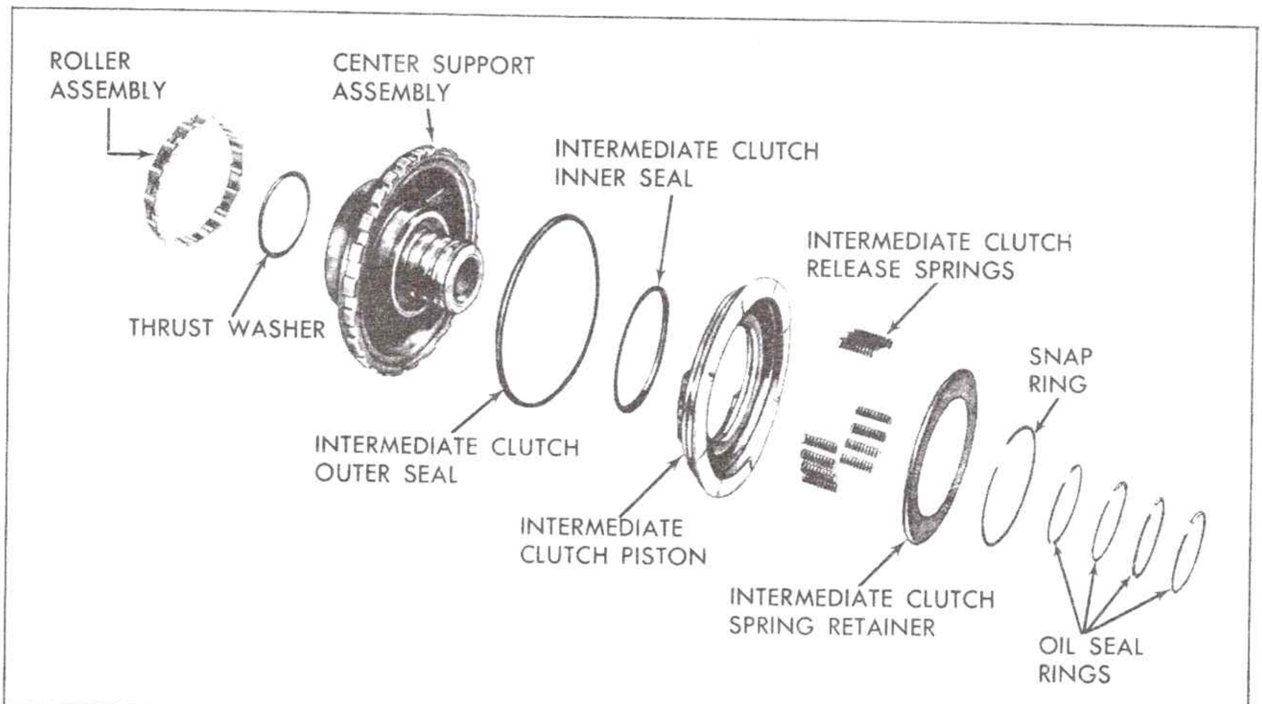


Fig. 7-174 Case Support Assembly Disassembled

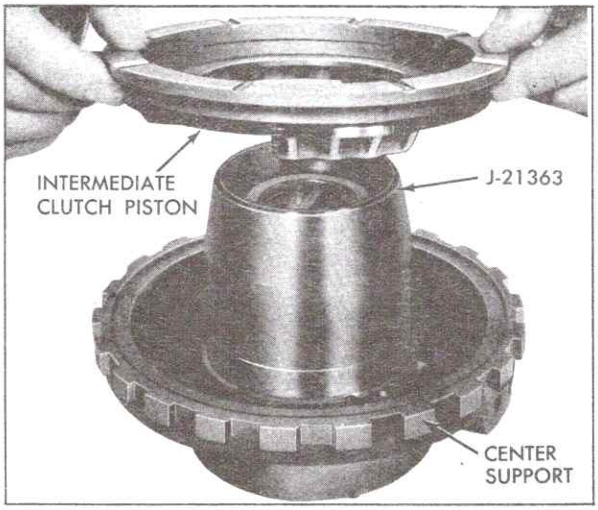


Fig. 7-175 Installing Intermediate Clutch Piston

c. Install twelve clutch release springs into spring pockets in clutch piston.

d. Place spring retainer and snap ring over springs.

e. Using Clutch Spring Compressor, J-4670, and Rear Clutch Spring Compressor, J-6129, Fig. 7-173, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

f. Install four new oil seal rings on center support.

g. Air check operation of intermediate clutch piston. Apply air through center oil feed hole to actuate clutch piston, Fig. 7-176.

h. Lubricate phenolic thrust washer with petrolatum and install washer in recess of center support, Fig. 7-177.

i. Install center support assembly into roller clutch in reaction carrier, Fig. 7-178.

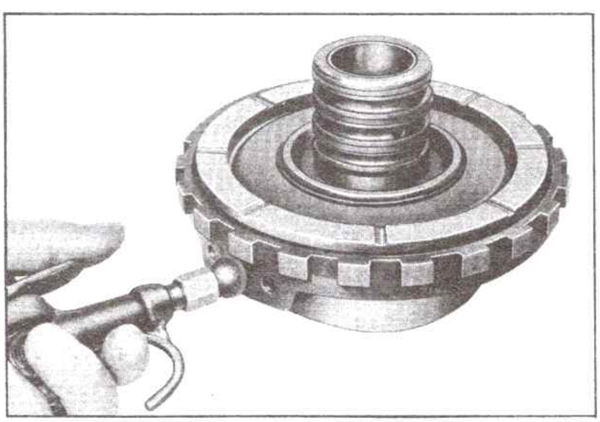


Fig. 7-176 Air Checking Intermediate Clutch

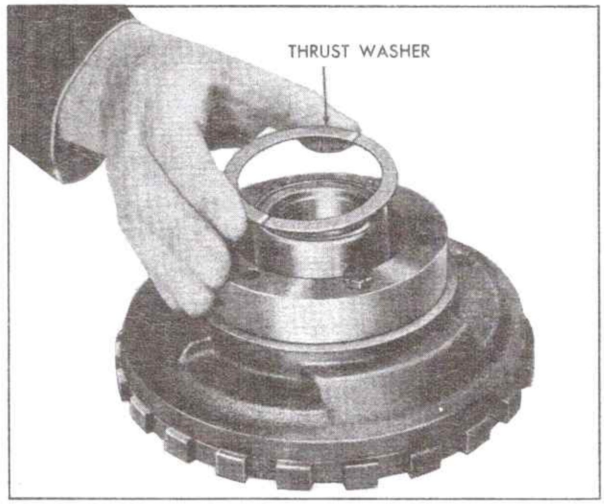


Fig. 7-177 Installing Center Support to Reaction Carrier Thrust Washer

NOTE: With reaction carrier held, center support should turn clockwise only.

j. Install Gear Assembly Remover and Installer Adapter, J-21795, on end of main shaft so that tangs engage groove in shaft. Using Slide Hammer Handle, J-6125, and Speedometer Puller Bolt, J-21797, tighten bolt on Tool to secure Tool on shaft and prevent movement of the roller clutch during installation of the gear unit assembly, Fig. 7-161.

15. Install Rear Band and Complete Gear Unit Assembly.

a. Inspect rear band for cracks or distortion and band ends for damage to anchor lugs and

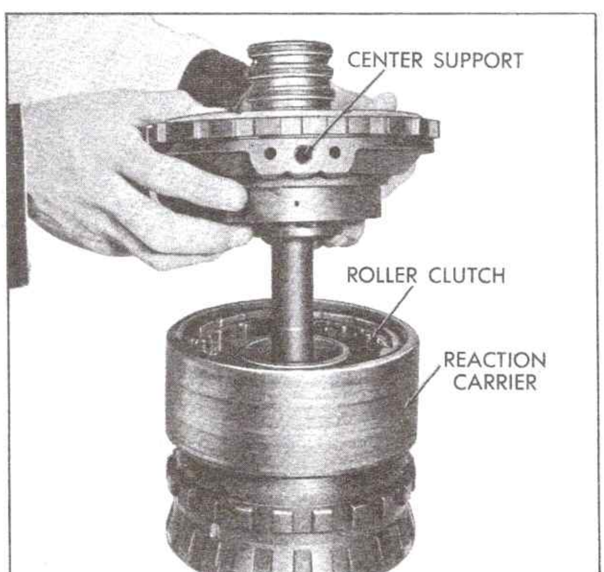


Fig. 7-178 Installing Center Support in Reaction Carrier

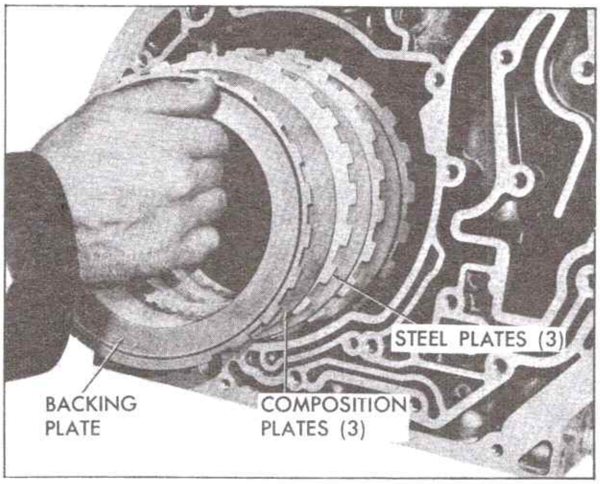


Fig. 7-179 Installing Intermediate Clutch Plates

apply lug. Also inspect lining for cracks, flaking, burning and looseness.

b. Install rear band assembly in transmission case so that band lugs index with anchor pins.

c. Install previously selected rear unit selective washer into slots provided inside rear of transmission case. Retain washer with petrolatum.

NOTE: Proper washer size was determined at time of rear unit end play check.

d. Lying gear unit on its side, install thrust washer on output flange with bent tabs in tab pockets. Retain thrust washer with petrolatum.

CAUTION: Be careful not to drop or bump gear unit assembly in transmission case during installation.

e. Install gear unit, with center support and reaction carrier, by lining up center support bolt hole with hole in case and carefully guiding complete assembly into transmission case. Install center support locating screw, tightening to 2 foot-pounds.

f. Lubricate tapped hole in center support with transmission fluid and install center support-to-case support bolt through case into center support, Fig. 7-160. Tighten bolt to 23 foot-pounds, and remove center support locating screw.

g. Lubricate center support to case snap ring with transmission fluid and install snap ring in transmission case with beveled side up, locating gap adjacent to front band anchor pin. Expand snap ring until center support is against shoulder of case.

h. Before installing intermediate clutch plates, inspect plates for signs of burning, scoring, and wear.

i. Lubricate three steel and three composition intermediate clutch plates with transmission fluid and install clutch plates in transmission case,

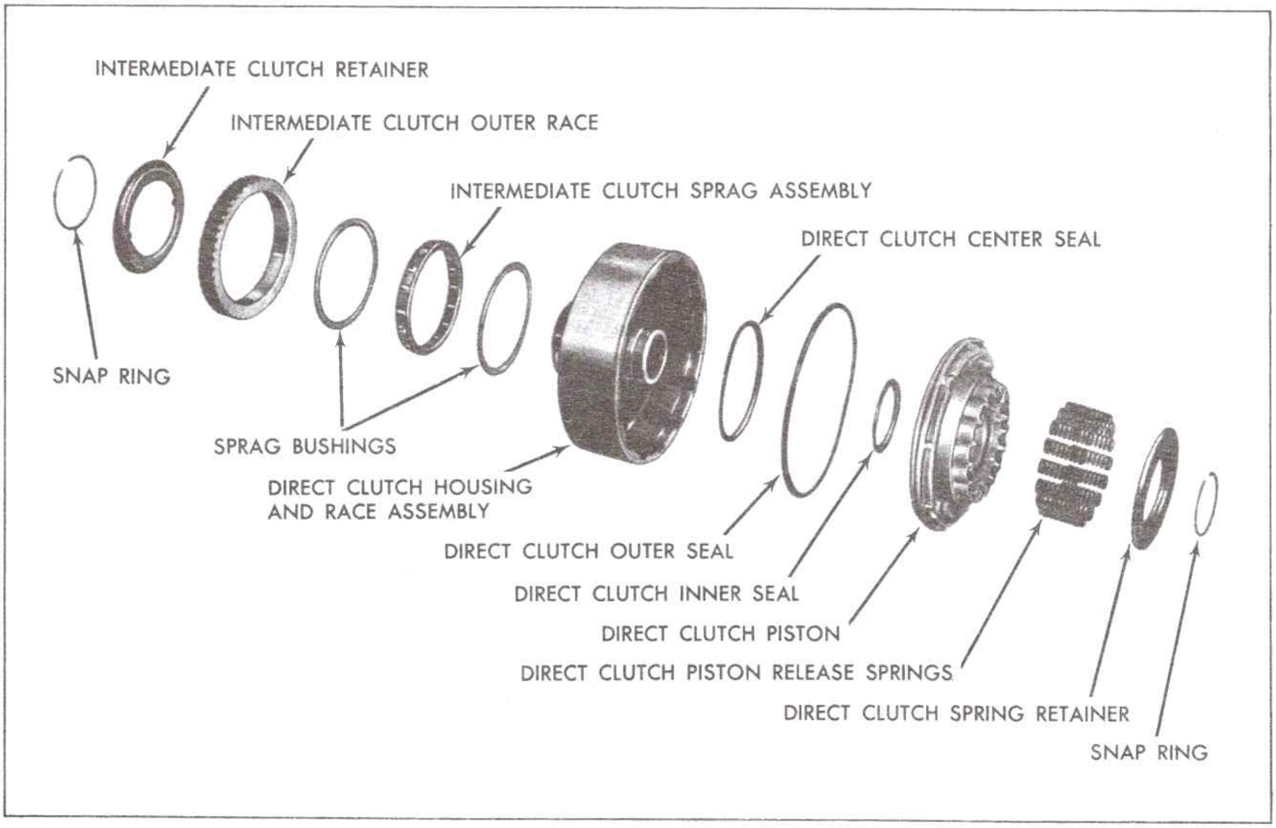


Fig. 7-180 Direct Clutch and Piston Disassembled

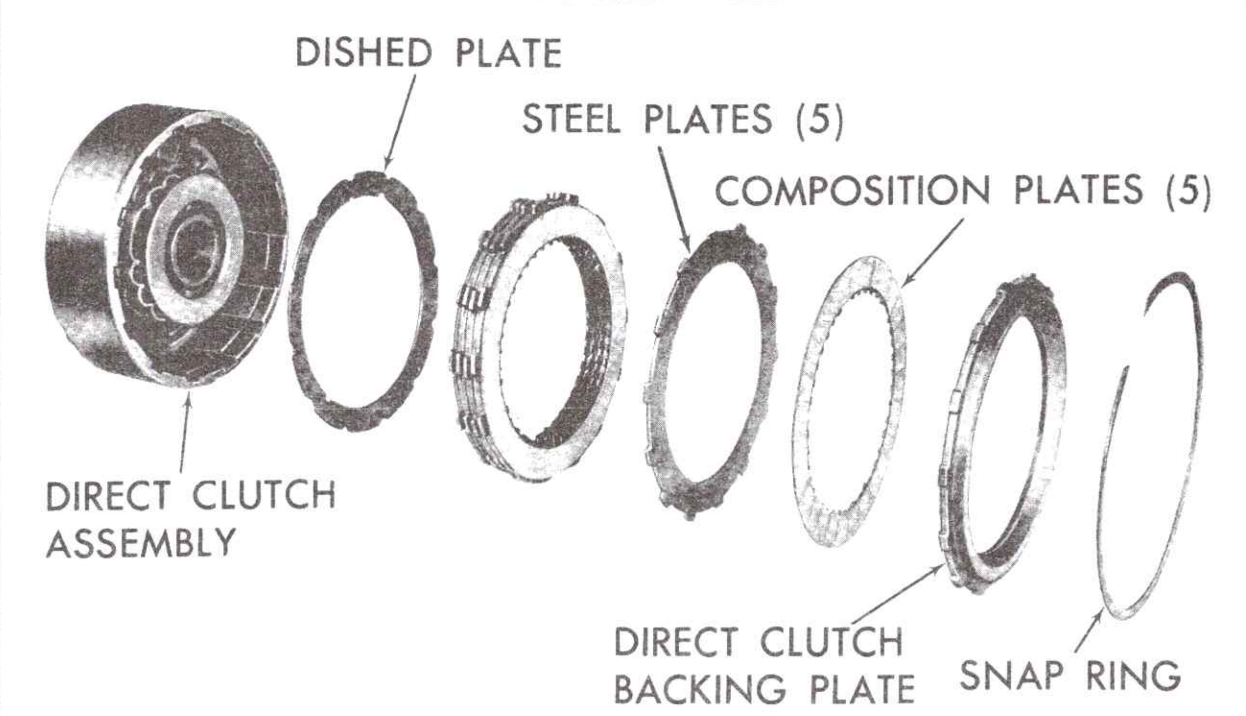


Fig. 7-181 Direct Clutch Disassembled

Fig. 7-179. Start with waved steel plate and alternate composition and steel plates.

j. Install intermediate clutch backing plate with machined surface against clutch plates.

k. Install backing plate to case snap ring with snap ring gap on side of case opposite front band anchor pin.

l. Recheck rear unit end play as described in Note 30r.

c. Direct Clutch and Intermediate Sprag Assembly (Fig. 7-180)

1. Disassembly

a. Remove sprag retainer snap ring, and remove clutch retainer.

b. Remove sprag outer race and bushings, and remove sprag assembly from outer race.

c. Turn unit over and remove direct clutch backing plate to clutch housing snap ring.

d. Remove direct clutch backing plate and five composition and five steel clutch plates and one dished steel plate, Fig. 7-181.

e. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-182, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.

f. Remove tools, spring retainer, and sixteen clutch release springs.

g. Remove direct clutch piston from direct clutch housing.

h. Remove inner and outer seals from clutch piston.

i. Remove center piston seal from direct clutch housing.

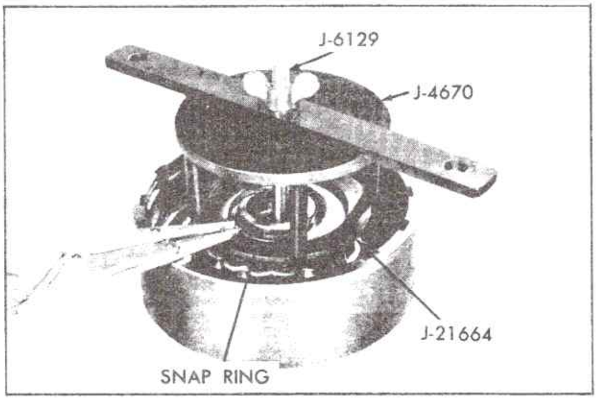


Fig. 7-182 Removing and Installing Direct Clutch Housing Snap Ring

2. Inspection

a. Inspect sprag assembly for popped or loose sprags.

b. Inspect sprag bushing for wear or distortion.

c. Inspect inner and outer races for scratches or wear.

d. Inspect clutch housing for cracks, wear, proper openings of oil passages and wear on clutch plate drive lugs.

e. Inspect drive and driven clutch plates for sign of wear or burning.

f. Inspect backing plate for scratches or other damage.

g. Inspect piston for cracks and free operation of ball check.

h. Inspect springs for collapsed coils or signs of distortion.

3. Assembly

a. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in direct clutch piston and install seals with lips facing away from spring pockets.

NOTE: Make certain piston has ball check.

b. Lubricate new center seal with transmission fluid. Lubricate seal groove in direct clutch housing and install seal in clutch housing with lip facing up.

c. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over direct clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in direct clutch housing, Fig. 7-183, and install clutch piston by rotating it slightly, in a clockwise direction.

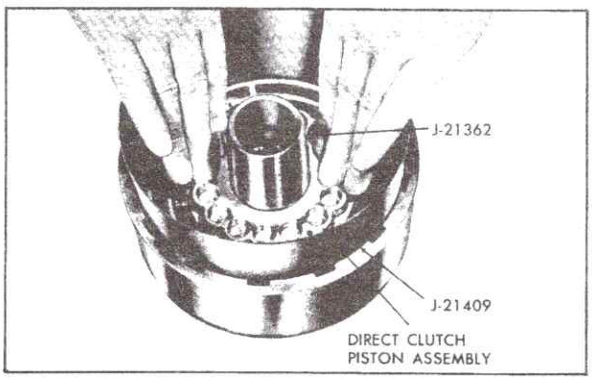


Fig. 7-183 Installing Direct Clutch Piston

d. Install 16 clutch release springs into spring pockets in clutch piston.

NOTE: Direct clutch release springs are red in color and are not interchangeable with the green colored springs used in the forward clutch piston.

e. Place spring retainer and snap ring over springs.

f. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-182, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

NOTE: Make certain clutch release springs are not leaning. If necessary, straighten springs with a small screwdriver.

g. Lubricate the five flat and one dished steel and five composition clutch plates with transmission fluid and install clutch plates in direct clutch housing. Start with dished steel plate and alternate flat steel and composition plates, Fig. 7-184.

NOTE: Do not use radially grooved composition plates here. Dished steel plate is installed with O.D. up.

h. Install direct clutch backing plate over clutch plates and install backing plate snap ring.

i. Invert clutch housing and install one sprag bushing, cup side up, around sprag inner race.

j. Install sprag assembly into clutch outer race.

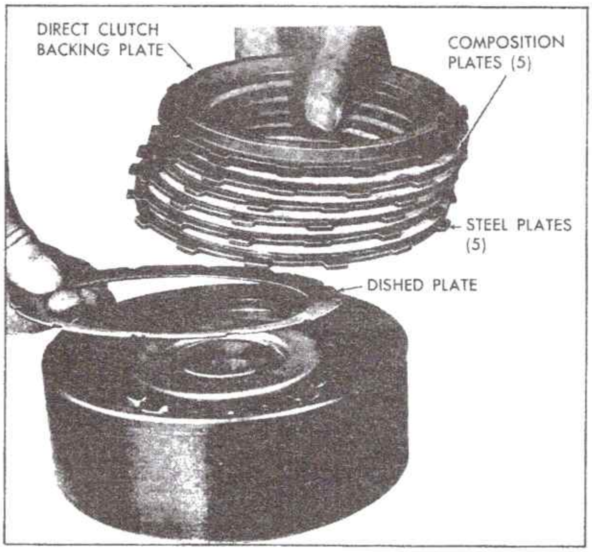


Fig. 7-184 Installing Direct Clutch Plates

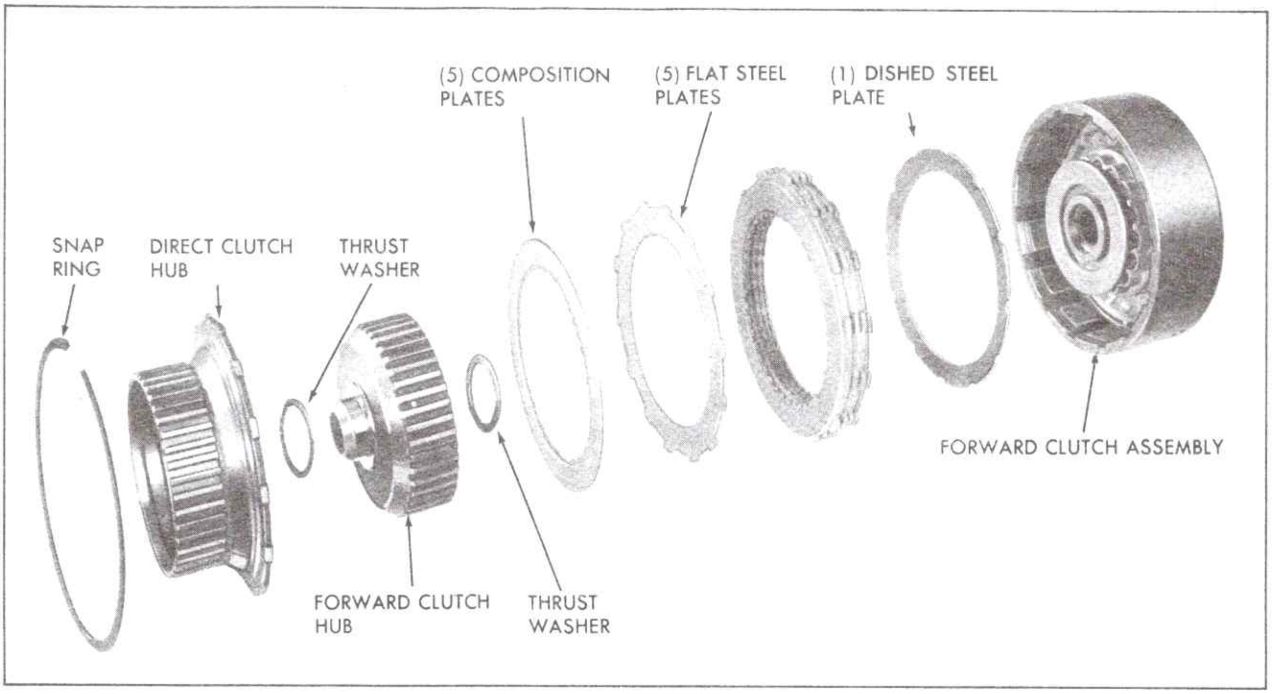


Fig. 7-186 Forward Clutch and Forward and Direct Clutch Hubs Disassembled

k. With ridge on inner cage of sprag facing up, install sprag and outer race on inner race with counter-clockwise turning motion.

NOTE: When installed, outer race should turn only counter-clockwise.

l. Install sprag bushing, cup side down, over sprag assembly.

m. Install sprag retainer and snap ring.

4. Install Front Band and Direct Clutch Assembly

a. Inspect front band for cracks or distortion

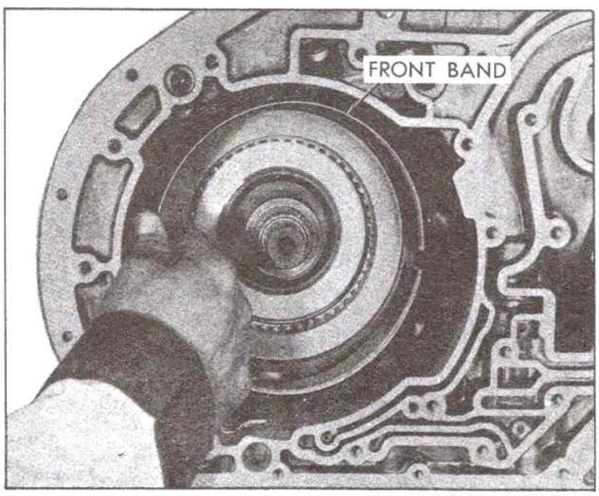


Fig. 7-185 Installing Front Band

and band ends for damage at anchor lug and apply lug. Also inspect lining for cracks, flaking, burning, and looseness.

b. Install front band with band anchor hole over band anchor pin, and apply lug facing servo hole, Fig. 7-185.

c. Install direct clutch housing and intermediate sprag assembly on center support. Make certain that clutch housing hub bottoms on sun gear shaft and splines on forward end of sun gear shaft are flush with splines in direct clutch housing.

NOTE: It will be necessary to rotate clutch housing to allow sprag outer race to index with intermediate clutch drive plates. Removal of direct clutch drive and driven plates may be helpful and applying air pressure through the center support screw to apply the intermediate clutch plates may facilitate assembly.

d. Install forward clutch hub to direct clutch housing thrust washer on forward clutch hub. Retain with petrolatum.

e. Check operation of direct clutch by applying air pressure through direct clutch passage next to center support bolt, Fig. 7-129.

d. Forward Clutch Assembly

1. Disassembly (Fig. 7-186)

a. Remove forward clutch housing to direct clutch hub snap ring.

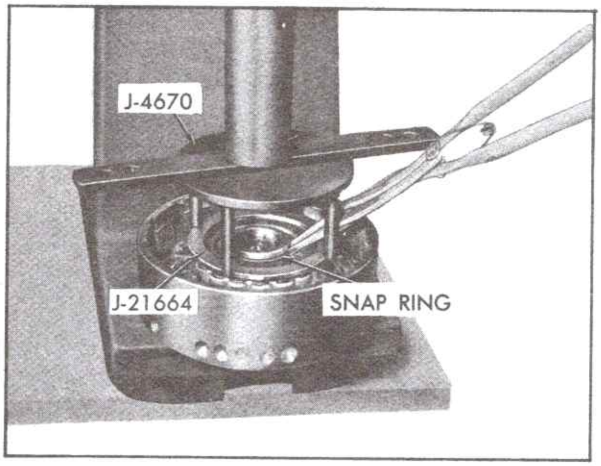


Fig. 7-187 Removing and Installing Forward Clutch Housing Snap Ring

b. Remove direct clutch hub.

c. Remove forward clutch hub and thrust washer from inner side of hub.

d. Remove five radially grooved composition and five flat and one dished steel clutch plates.

e. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press and remove snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-187.

f. Remove tools, spring retainer and 16 clutch release springs.

g. Remove forward clutch piston from forward clutch housing.

h. Remove inner and outer seals from clutch piston.

i. Remove center piston seal from forward clutch housing.

2. Inspection

a. Inspect drive and driven clutch plates for signs of burning, scoring or wear.

b. Inspect sixteen release springs for collapsed coils or signs of distortion.

c. Inspect clutch hubs for worn splines, proper lubrication holes, and thrust faces.

d. Inspect piston for cracks.

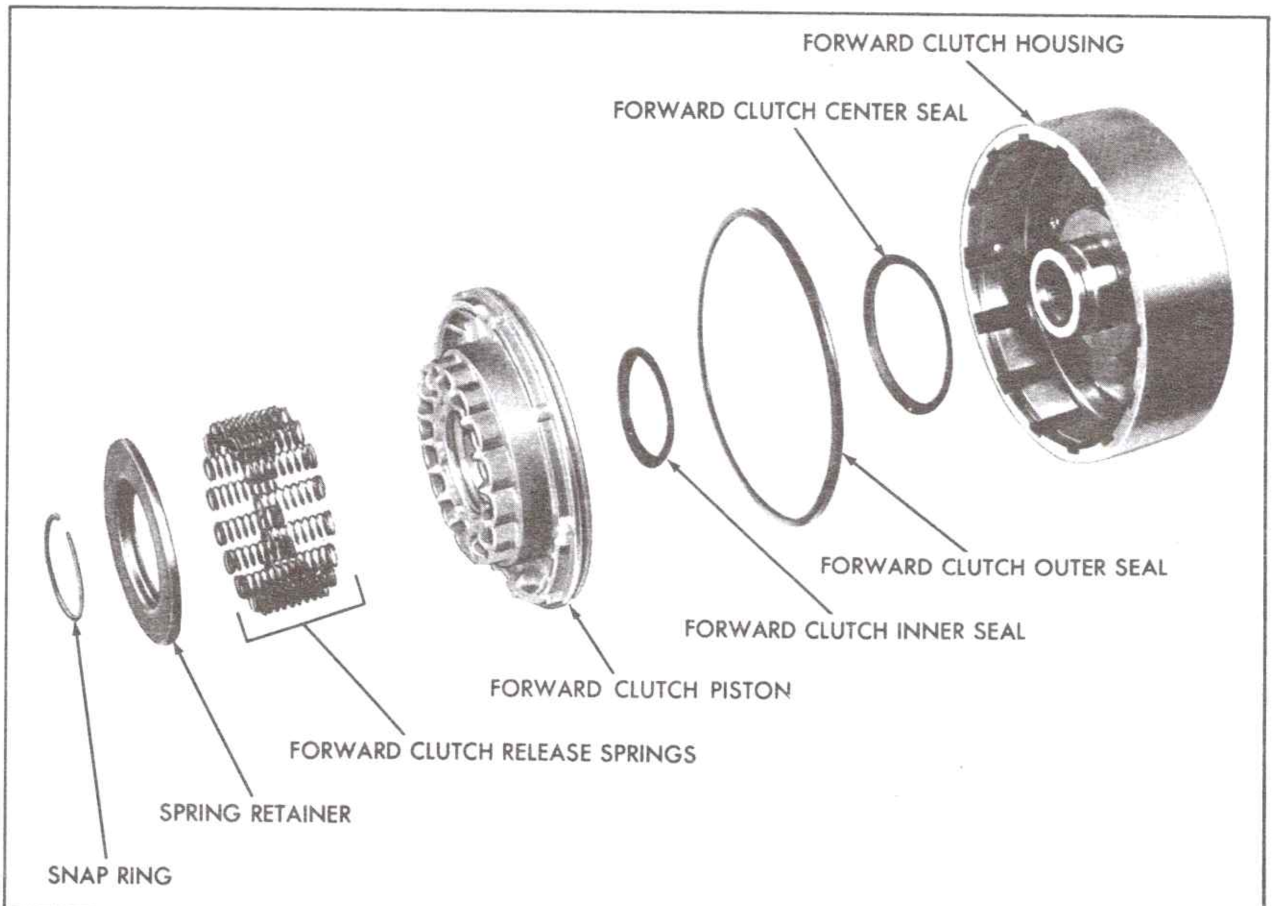


Fig. 7-188 Forward Clutch Disassembled

e. Inspect clutch housing for wear, scoring, cracks and open oil passages.

3. Assembly (Fig. 7-188)

a. Invert forward clutch housing on arbor press.

b. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in forward clutch piston with petrolatum and install seals with lips facing away from spring pockets.

NOTE: The forward and direct clutch pistons have identical inside and outside diameters. Therefore, extreme care should be exercised during reassembly to assure the proper piston be installed in the clutch assemblies. The forward clutch piston can be identified by the absence of a check ball in the clutch apply face of the piston.

c. Lubricate new center piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and install seal into clutch housing with lip facing up.

d. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over forward clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in forward clutch housing, Fig. 7-189, and install clutch piston by rotating it slightly in a clockwise direction until seated.

e. Install sixteen clutch release springs into spring pockets in clutch piston.

NOTE: Forward clutch release springs are dyed green and are not interchangeable with the red colored springs used in the direct clutch piston.

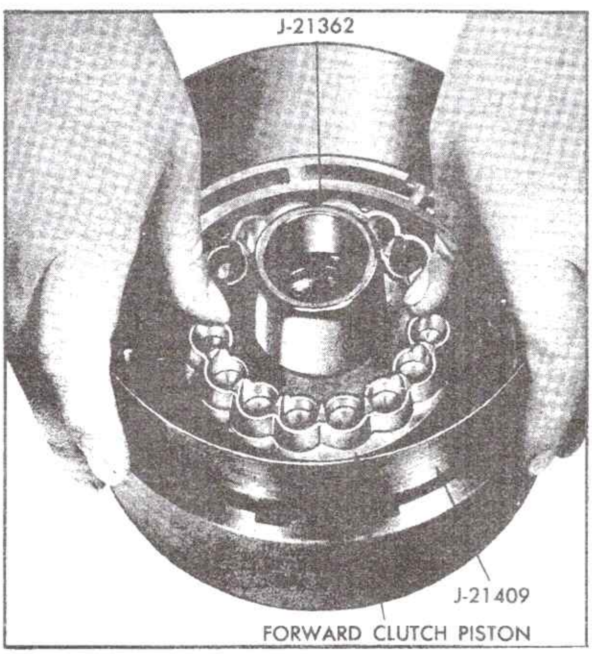


Fig. 7-189 Installing Forward Clutch Piston

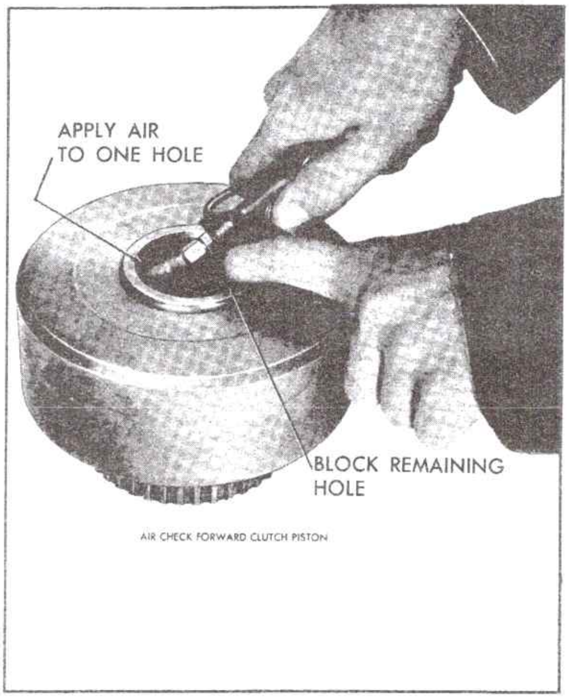


Fig. 7-190 Air Checking Forward Clutch

f. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press, being careful that retainer does not catch in snap ring groove, and install snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-187 and remove tools.

CAUTION: Make certain clutch release springs are not leaning. If necessary, straighten with a small screwdriver.

g. Remove forward clutch assembly from arbor press and place on work bench.

h. Install phenolic thrust washer on the inside of forward clutch hub.

i. Install forward clutch hub in forward clutch housing.

j. Lubricate the dished and five flat steel and five radially grooved composition clutch plates with transmission fluid and install clutch plates in forward clutch housing. Start with dished steel plate and alternate flat steel and composition plates.

NOTE: Dished steel plate is installed with O.D. up.

Be sure radially grooved composition plates are used only in the forward clutch.

k. Install direct clutch hub in forward clutch

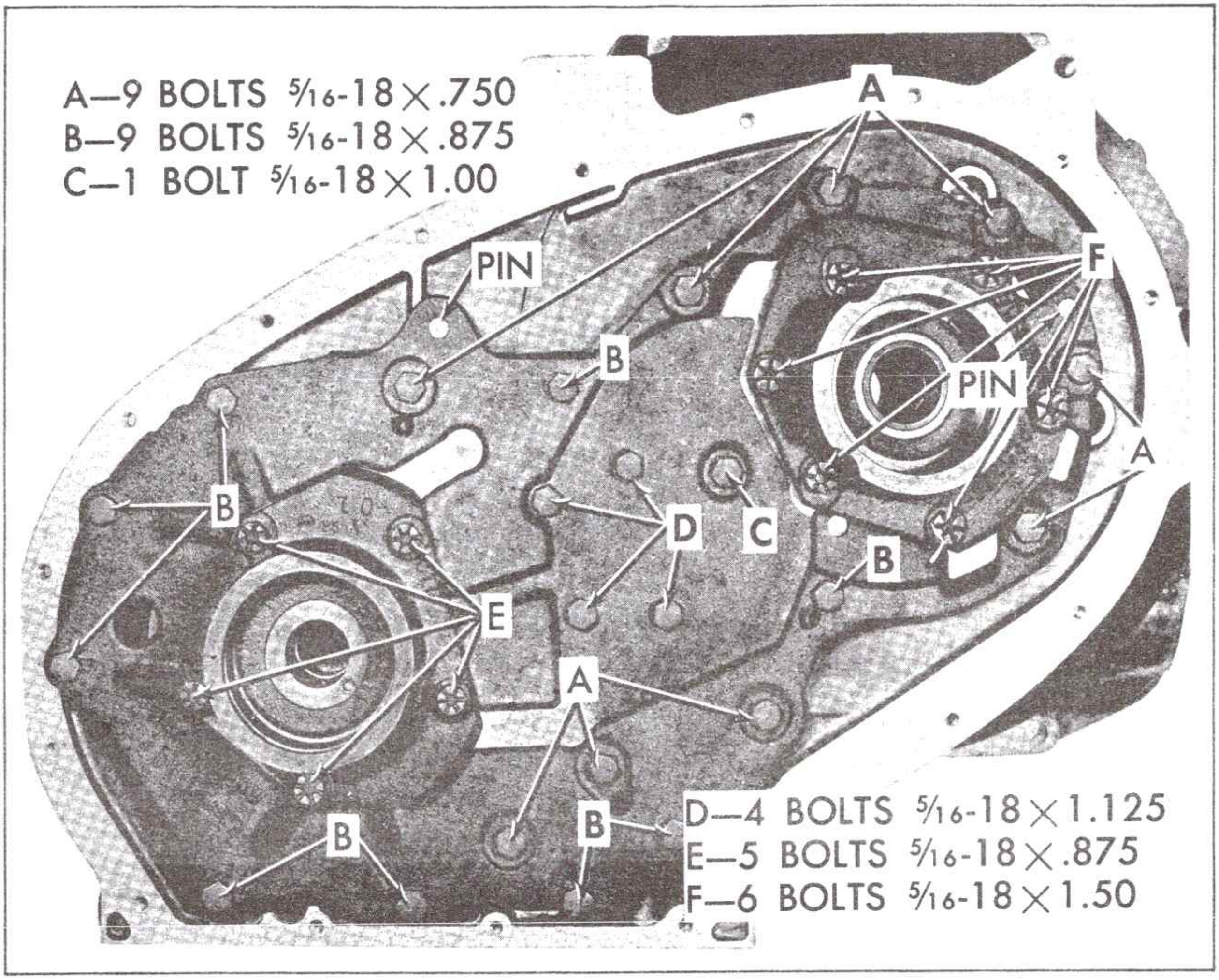


Fig. 7-191 Pump Cover Plate Bolt Chart

housing over clutch plates, and install snap ring.

1. Air check forward clutch and piston operation. Fig. 7-190.

4. Install Forward Clutch

a. Install Front Unit End Play Checking Tool, J-22241 into forward clutch, Fig. 7-158.

b. Install forward clutch assembly into transmission, making certain main shaft goes into forward clutch hub. It will be necessary to rotate clutch housing to allow direct clutch driving hub to index with direct clutch drive plates.

c. Remove Front Unit End Play Checking Tool, J-22241.

e. Install Pump Cover Plate

1. Install new pump cover plate gasket on transmission.

2. Install pump cover plate on transmission and install attaching bolts per bolt chart, Fig. 7-191.

NOTE: Do not install pump attaching bolts (F) or single bolt (E) in pump cover plate at this time.

3. Using the driven sprocket as a driver rotate the forward clutch.

NOTE: If the forward clutch housing cannot be rotated as the pump cover plate is being pulled into place, the forward or direct clutch housings have not been properly installed to index with all the clutch plates. This condition must be corrected before the pump cover plate is pulled fully into place.

4. Torque all bolts to 20 foot-pounds.

5. Repeat front unit end play check as described in Note 30n.

6. Install remaining bolt (E) in driven support housing, tightening to 20 foot-pounds.

f. Oil Pump

1. Disassembly

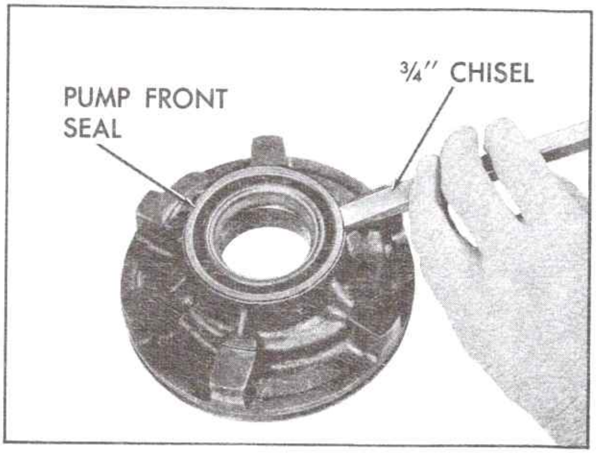


Fig. 7-192 Removing Pump Front Seal

a. Mark drive and driven gears for reassembly.

b. Remove drive and driven gears from pump body.

c. Remove and discard pump body to case square-cut O-ring seal.

2. Inspection

a. Using tip of finger, inspect gear pocket and crescent for nicks, burrs, scoring or galling.

b. Inspect drive gear for nicks, burrs, scoring, or galling.

c. Inspect driven gear for nicks, burrs, scoring, or galling.

d. Place pump gears in pump body and check

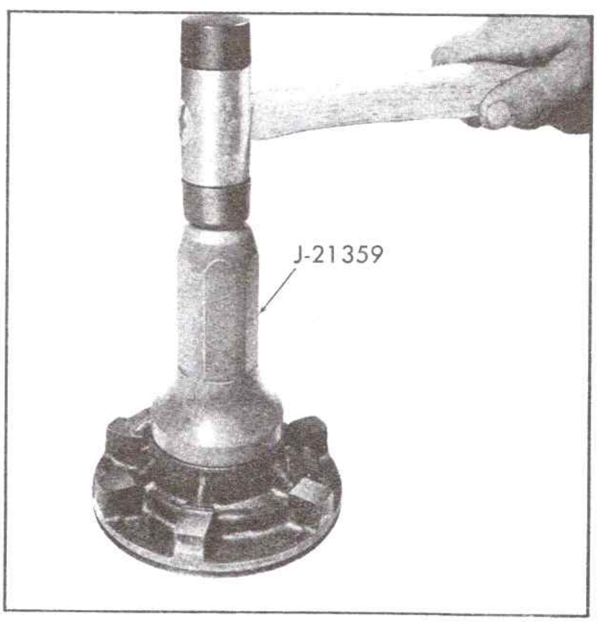


Fig. 7-193 Installing Pump Front Seal

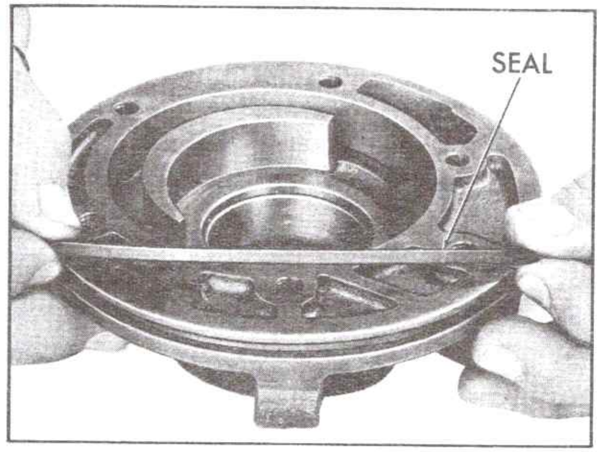


Fig. 7-194 Installing Pump to Case Seal

pump body face to gear face clearance. Clearance should be .0008 inch - .0015 inch, Fig. 7-58.

e. Check face of pump body for nicks, burrs, scoring, or galling.

f. Check pump body face flatness. Overall flatness should be .000" to .002".

g. Inspect bushing for nicks, burrs, scoring, galling, out-of-round, or excessive wear.

NOTE: To check for out-of-round, install pump body on the converter hub and look for eccentricity between pump bushing and converter hub.

h. Check for damaged pump cover plate bolt holes.

i. Inspect front seal for damage. If replacement of front seal is necessary, use a standard 3/4" cold chisel and pry front seal from pump body, Fig. 7-192.

3. Assembly

a. If necessary, install a new front seal, using

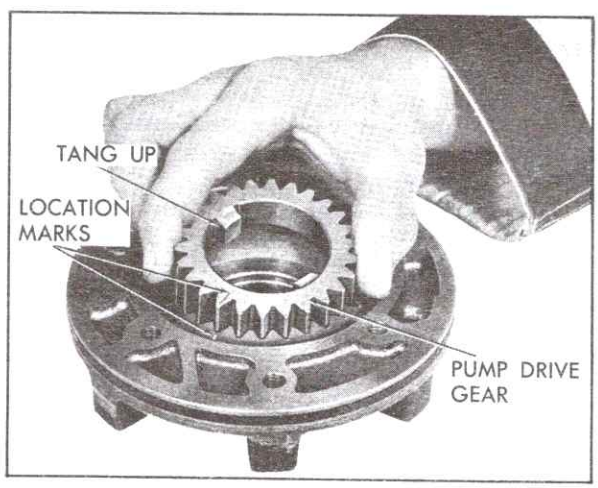


Fig. 7-195 Installing Pump Drive Gear

Pump Oil Seal Installer, J-21359, to drive seal in place. Use a non-hardening sealer on outside of seal before installing into pump, Fig. 7-193.

b. Install new pump to case square-cut O-ring seal, Fig. 7-194.

c. Install driven gear into pump body with alignment mark up.

d. Install drive gear into pump body with drive tangs up, Fig. 7-195.

NOTE: Drive gear should always be installed with counterbore down.

4. Install

a. Rotate transmission in Holding Fixture Base so that cored oil passages are up.

b. Install pump assembly over stator shaft and position to drive support housing, rotating pump as necessary to align holes in pump cover plate with pump attaching bolt holes.

c. Install six retaining bolts (F), finger tight, Fig. 7-191.

d. Rotate transmission in Holding Fixture Base so that pump cover plate is up.

e. Tighten pump attaching bolts to 20 ft. lbs.

g. Install Sprockets, Link Assembly and Sprocket Cover

1. Rotate transmission in Holding Fixture Base so that cored oil passages are up.

2. Position drive and driven sprockets on workbench with shafts up, and drive sprocket closest to transmission.

3. Install link assembly over drive and driven sprockets with colored guide link down.

4. Lift sprockets and link assembly and rotate assemblies 90° so that drive sprocket is up.

5. Allowing driven sprocket to hang down freely, start turbine shaft into pump support housing until it will support weight of assembly.

6. Start input shaft into driven support housing, and alternately push shafts inward until sprockets are installed.

7. Rotate transmission in Holding Fixture Base so that sprockets are up.

8. Using a plastic mallet, gently tap sprockets to seat sprocket bearing assemblies into support housing.

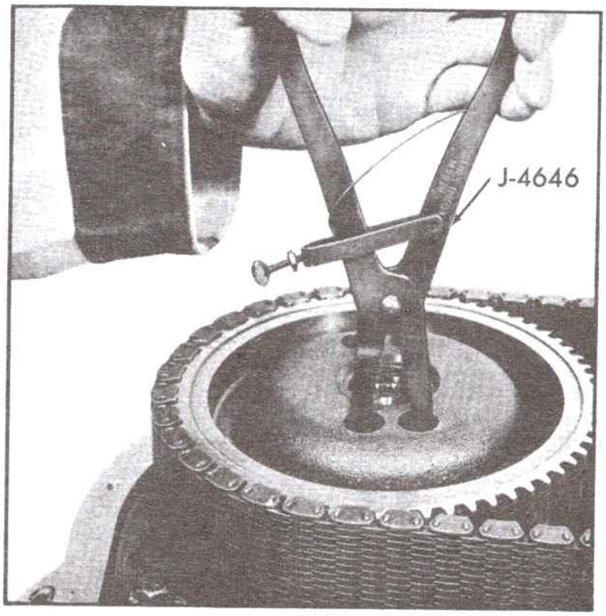


Fig. 7-196 Installing Sprocket Snap Rings

9. Install Snap Ring Pliers, J-4646, into sprocket bearing retainer snap rings, located under the drive and driven sprockets, and install snap rings into retaining grooves on support housings, Fig. 7-196.

10. Install new sprocket cover to case gasket on transmission case.

11. Position sprocket cover to transmission case and install 18 attaching bolts, tightening bolts to 8 ft. lbs.

NOTE: One sprocket cover attaching bolt is 1/4 inch longer. This bolt must be installed in the tapped hole directly over the cooler fittings on the transmission case.

h. Detent Lever, Manual Shaft, Parking Linkage, Rear Servo, Front Servo, Check Balls, Control Valve Spacer and Stator Solenoid

1. Inspect Detent Lever, Manual Shaft, and Parking Linkage

a. Inspect parking actuator rod for cracks, or broken spring retainer lugs.

b. Inspect actuator spring for damage.

c. Inspect actuator for a free fit on actuator rod.

d. Inspect parking pawl for cracks or wear.

e. Inspect manual shaft for damaged threads.

f. Inspect inside detent lever for cracks or a loose pin.

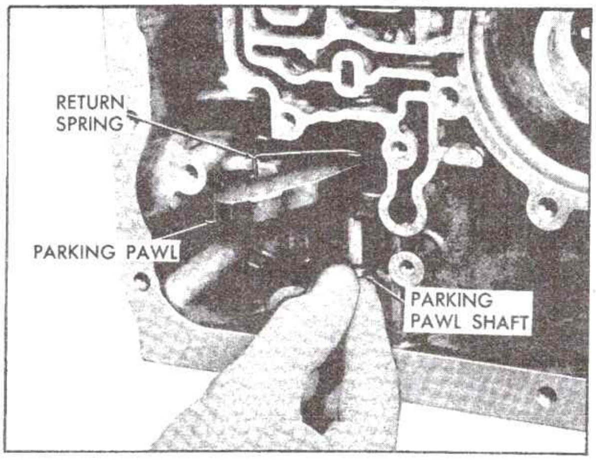


Fig. 7-197 Installing Parking Pawl

g. Inspect parking pawl return spring for deformed coils or ends.

h. Inspect parking bracket for cracks or wear.

i. Inspect detent spring and roller assembly.

2. Install Detent Lever, Manual Shaft and Parking Linkage

a. Install parking pawl (tooth toward inside of case), pawl return spring and parking pawl shaft into case, Fig. 7-197.

b. Install parking pawl shaft retaining pin into case hole.

c. Install parking bracket into case, tightening attaching screws to 18 ft. lbs.

d. Install a new manual shaft O-ring seal on manual shaft.

e. Install the actuator rod plunger under the parking bracket and over the parking pawl and through hole in detent lever. Position detent lever in transmission case.

f. Install the manual shaft assembly through the case and detent lever, Fig. 7-198, and install the retaining lock nut on manual shaft.

g. Install manual shaft retaining pin into case, long smooth end first.

h. Torque lock nut to 18 ft. lbs.

3. Disassemble Rear Servo Assembly (Fig. 7-199)

a. Remove rear accumulator piston from rear servo piston.

b. Remove E-ring retaining rear servo piston to band apply pin.

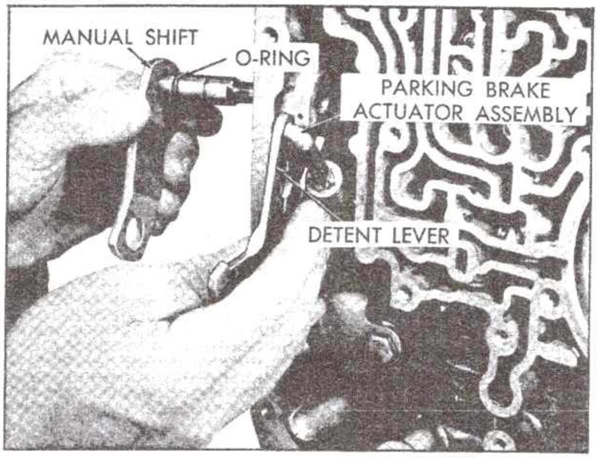


Fig. 7-198 Installing Manual Shaft

c. Remove rear servo piston and seal from band apply pin.

d. Remove washer, spring and retainer.

4. Inspect Rear Servo

a. Inspect fit of oil seal rings in accumulator piston. Clearance between side of ring and groove should be free with a maximum clearance of .003 inch.

b. Install accumulator oil seal ring in case bore and check fit of ring to bore.

c. Inspect fit of band apply pin in servo piston.

d. Inspect band apply pin for scores or cracks.

e. Inspect band apply pin for proper size as determined by pin selection check (Note 30h).

5. Assemble Rear Servo

a. Install spring retainer, cup side first, servo pin spring and washer on band apply pin.

b. Install servo piston on pin and secure with E-ring retainer.

c. If removed, install oil seal ring on servo piston.

d. If removed, install inner and outer oil rings on accumulator piston.

e. Install accumulator piston into bore of servo piston.

6. Install Rear Servo

a. Lubricate inner and outer rear servo bores in transmission case with transmission fluid and

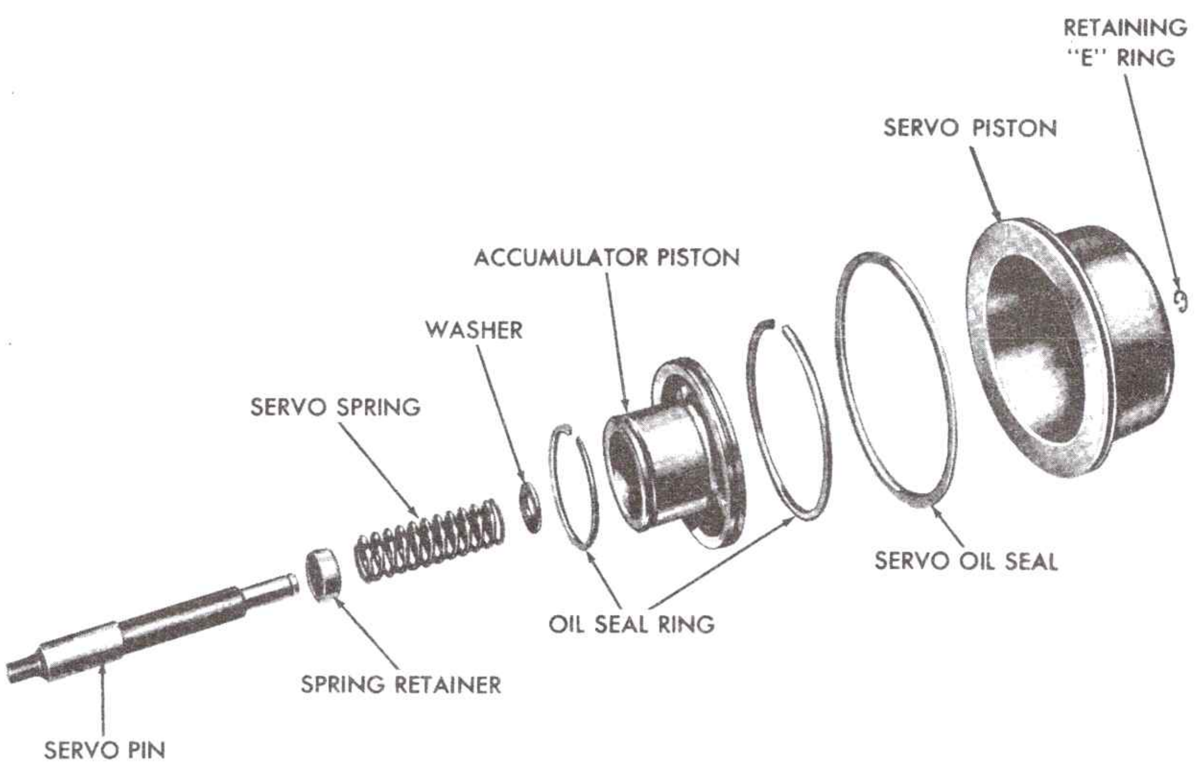


Fig. 7-199 Rear Servo and Accumulator Assembly Disassembled

install rear accumulator spring in servo inner bore.

NOTE: Before installing rear servo assembly, make certain that rear band apply lug is aligned with servo pin bore in transmission case. Otherwise servo pin will not apply band.

b. Position rear servo assembly in transmission case bore.

c. Press down on rear servo assembly, making certain oil seal ring is properly seated in case bore.

7. Inspect Front Servo

a. Inspect servo pin for damage.

b. Inspect piston for damaged oil ring groove, check freedom of ring in groove.

c. Inspect piston for cracks or porosity.

d. Check fit of servo pin in piston.

8. Install Front Servo Assembly

a. Reassemble parts of front servo, Fig. 7-200, making sure tapered end of servo pin is pointing through the spring and spring retainer, and install in bore in case.

9. Install Check Balls, Control Valve Spacer and Stator Solenoid

a. Install seven check balls in cored passages, Fig. 7-201.

b. Install valve body spacer to case gasket (gasket with extension for stator solenoid) on transmission case.

c. Install valve body spacer on transmission.

d. Install valve body to spacer gasket.

e. Position stator solenoid gasket and stator solenoid to transmission case and secure with two attaching bolts. Do not tighten bolts at this time.

NOTE: Connector wire of stator solenoid should be positioned over parking pawl.

i. Control Valve Assembly (Fig. 7-202)

1. Disassembly

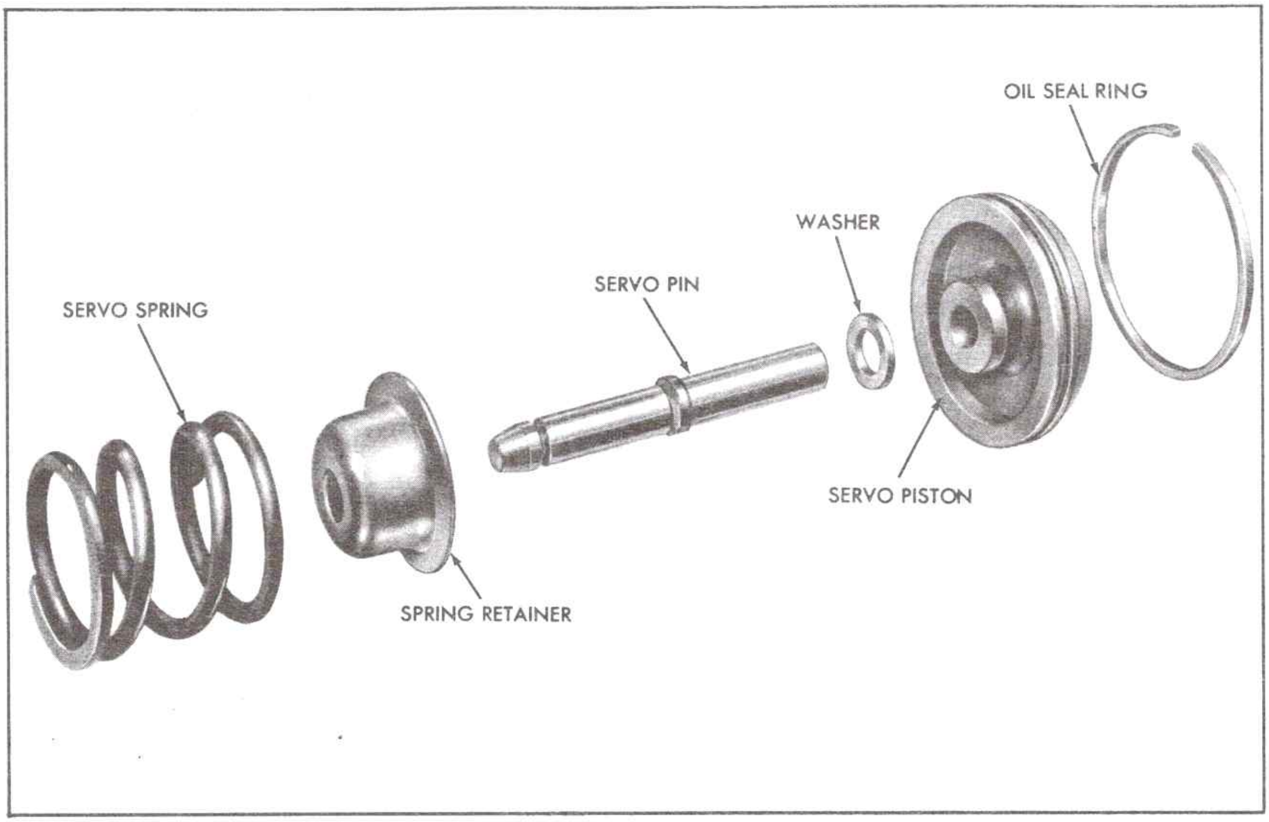


Fig. 7-200 Front Servo Disassembled

When disassembling control valve, make certain that springs are accurately identified so that they can be properly reassembled.

a. Position control valve assembly with cored face down.

b. Remove two screws securing detent solenoid to control valve body and remove detent solenoid and gasket.

c. Position control valve assembly with cored face up and accumulator pocket on bottom.

d. Remove manual valve from upper bore.

e. Install Control Valve Accumulator Piston Installer, J-21885, on accumulator piston, compress piston and remove E-ring retainer, Fig. 7-203.

f. Remove Installer, J-21885, and remove accumulator piston and spring.

g. Using pin punch, remove retaining pin from lower left bore, pressing on pin from outer side of valve body. Remove 2-3 modulator bushing, 2-3 shift valve spring, 2-3 modulator valve, 3-2 intermediate spring and 2-3 shift valve from lower left bore.

NOTE: 2-3 modulator valve will be inside of 2-3 modulator bushing.

h. Using pin punch, remove retaining pin from lower center left bore, pressing on pin from outer side of valve body. Remove 1-2 modulator bushing, 1-2 regulator valve and spring, 1-2 detent valve and 1-2 shift valve from lower left center bore.

NOTE: 1-2 regulator valve and spring may be inside of 1-2 modulator bushing.

i. Using pin punch, remove retainer pin from upper left center bore by pressing on outer side of valve body.

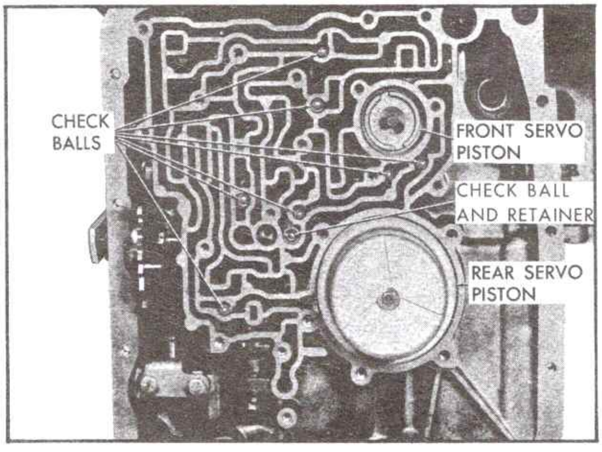


Fig. 7-201 Location of Check Balls

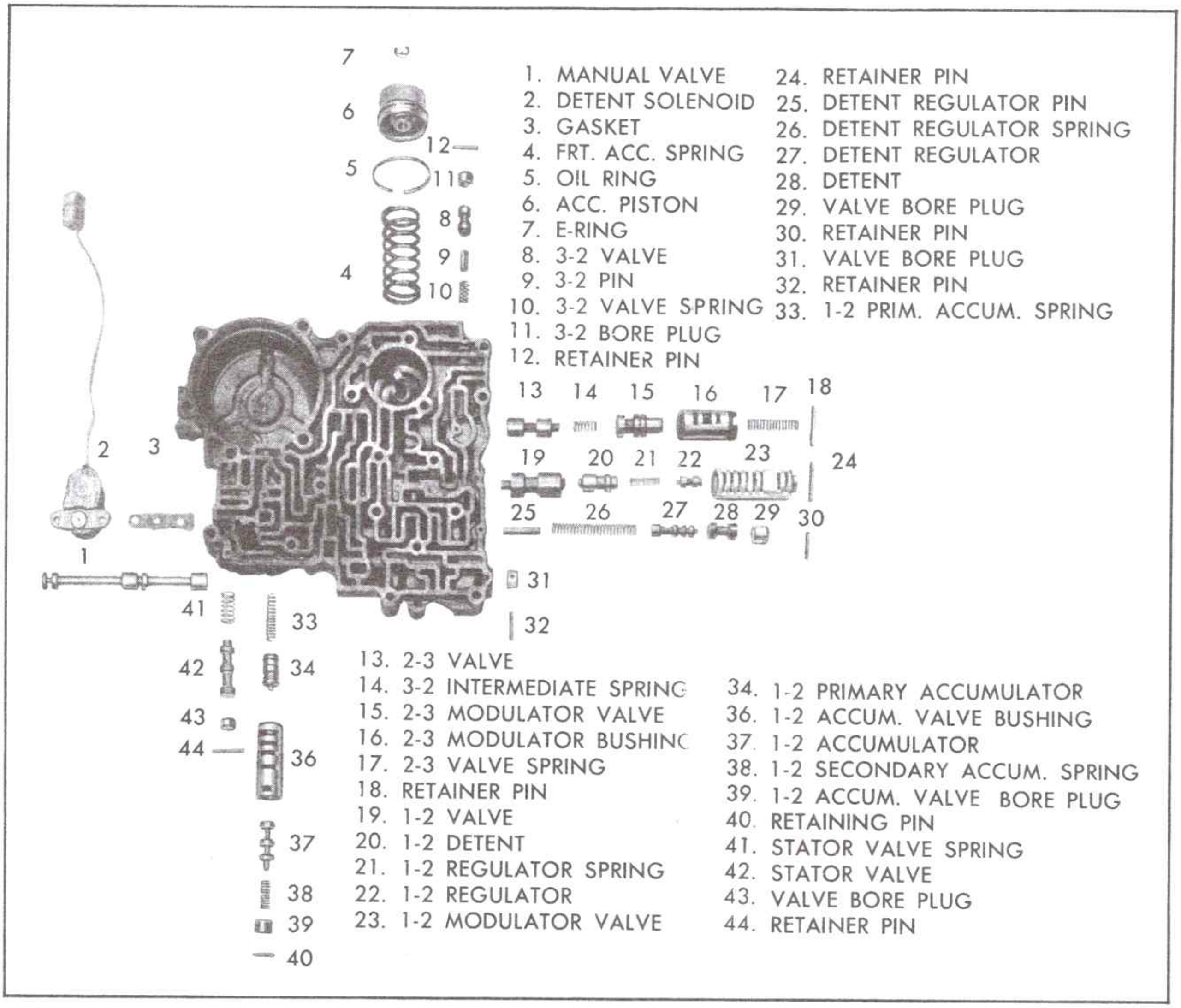


Fig. 7-202 Control Valve Assembly Disassembled

CAUTION: Hold hand over bore when removing retainer pin as detent regulator valve spring may force other components out of bore.

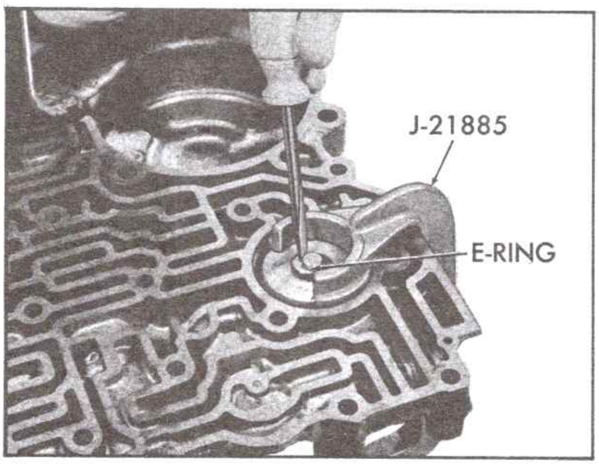


Fig. 7-203 Removing Front Accumulator

j. Remove bore plug, detent valve, detent regulator valve, spacer and detent regulator valve spring from upper left center bore.

k. Remove retaining pin from bottom bore on left side by prying out with a pair of long nose pliers.

CAUTION: Hold hand over bore when removing retainer pin as 3-2 valve spring may force bore plug out.

l. Remove bore plug, 3-2 valve spring, spacer and 3-2 valve from lower right bore.

m. Using a pin punch, remove retaining pin from top right bore, pressing on pin from outer side of valve body. Remove bore plug, stator valve and spring from top right bore.

n. Remove retaining pin from top bore next to stator valve bore by prying out with long nose pliers from outer side of valve body.

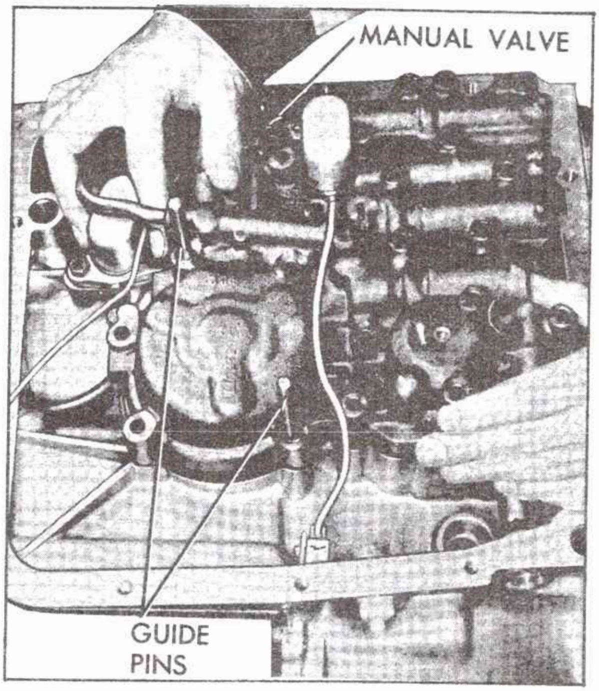


Fig. 7-204 Installing Control Valve Assembly

CAUTION: Hold hand over bore when removing retainer pin as accumulator springs may force other components out of bore.

o. Remove bore plug, 1-2 accumulator valve bushing, 1-2 accumulator valve and secondary spring, 1-2 accumulator primary valve and spring.

2. Inspection

a. Wash control valve body, valves, and other parts in clean solvent.

CAUTION: Do not allow valves to bump together, as this might cause nicks and burrs.

b. Inspect all valves and bushings carefully to make sure that they are free from dirt and are not damaged in any respect. If burrs are present, they should be removed with a fine stone or fine grade of crocus cloth and light oil. Be careful not to round off shoulders of valves.

c. All valves and bushings should be tested in their individual bores to make certain that free

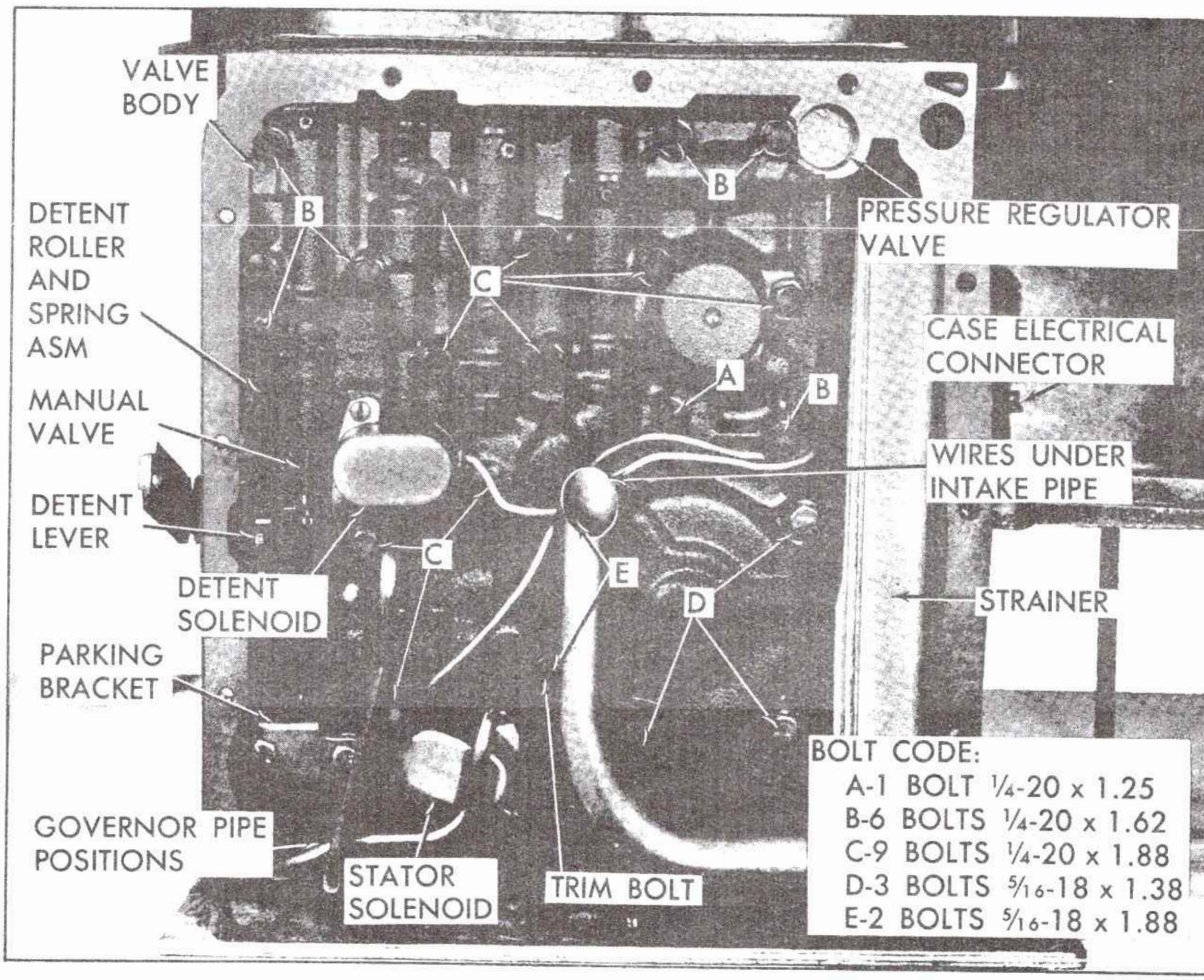


Fig. 7-205 Control Valve Bolt Chart

movement can be obtained. All valves should fall freely of their own weight with a slight tapping action on the body. In checking be careful to prevent valve damage in any way.

d. The manual valve is the only valve that can be serviced separately. If other valves are defective or damaged beyond repair, a new control valve assembly should be installed.

e. Inspect body for cracks or scored bores.

f. Check all springs for distortion or collapsed coils.

3. Assembly (Fig. 7-202)

a. Position control valve body with cored face up and accumulator pocket on bottom.

b. Install the 1-2 primary accumulator spring into the 1-2 primary accumulator valve and install both, spring first, into top bore next to stator bore.

c. Install the 1-2 accumulator valve, wide land first, into the 1-2 accumulator bushing.

d. Install the 1-2 accumulator valve bushing into the top bore, aligning the square port on the end of the bushing with hole for retaining pin.

e. Install the 1-2 secondary accumulator spring and the 1-2 bore plug into bushing.

f. Compress 1-2 accumulator valve train, install retaining pin from outer side of valve body, pressing pin flush with valve body.

g. Install spring, stator valve, stem end first and bore plug into top right bore.

h. Install stator valve retaining pin from cored side of valve body.

i. Install 3-2 valve in bottom left bore.

j. Insert spacer inside of 3-2 valve spring and install spring and spacer in bottom left bore.

k. Compressing 3-2 valve spring, install bore plug, hole end out, and secure with grooved retaining pin from cored side of valve body.

l. Insert spacer inside of detent regulator valve spring and install spring and spacer into upper left center bore, making certain spring seats in bottom of bore.

m. Compress detent regulator valve spring and hold with a small screwdriver placed between end of spring and wall on cored side of valve body.

n. Install detent regulator valve, stem end out, and detent valve, small land first, into upper left center bore.

o. Insert bore plug, hole out, into upper left center bore and, pressing inward on bore plug, remove screwdriver and install retaining pin from cored side of valve body.

p. Install 1-2 shift valve, stem end first, in lower left center bore, making certain valve seats in bottom of bore.

q. Install 1-2 regulator valve larger stem first, spring and 1-2 detent valve, hole end first, into 1-2 modulator bushing. Align spring in bore of 1-2 detent valve, and install assembly in lower left center bore of control valve body, detent valve first.

r. Compress bushing against spring and secure with retaining pin from cored side of control valve body.

s. Install 3-2 intermediate spring on stem end of 2-3 shift valve, and install valve and spring, valve first, into lower left bore. Make certain valve seats in bottom of bore.

t. Install 2-3 modulator valve, hole end first, into 2-3 modulator bushing and install both parts in lower left bore.

u. Install 2-3 shift valve spring into hole in 2-3 modulator valve, and compressing spring, secure with retaining pin from cored side of control valve.

v. Position front accumulator spring and piston into valve body and install Control Valve Accumulator Piston Installer, J-21885, on piston. Compress spring and piston, aligning spring and piston with bore, Fig. 7-203.

CAUTION: Make certain that piston pin is correctly aligned with hole in piston and that oil seal ring does not catch on lip of bore when installing piston.

w. Secure piston and spring with E-ring retainer and remove Installer, J-21885.

x. Placing control valve assembly on cored surface, position detent solenoid gasket and detent solenoid on valve body.

y. Install detent solenoid attaching screws.

z. Install governor drive pipe into control valve body in bore by rear servo cover.

4. Install Control Valve Assembly

a. Using two guide pins, Fig. 7-204, install control valve assembly and governor pipe on

transmission. Make certain gaskets and spacer do not become mispositioned.

NOTE: Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipe to make certain it is properly seated in case hole.

b. Remove guide pins and install control valve assembly attaching screws, eliminating detent roller and spring assembly attaching screw. Torque bolts to 8 foot-pounds.

c. Tighten stator solenoid attaching bolts to 10 foot-pounds.

d. Install detent roller and spring assembly and attaching screw. Tighten screw to 8 foot-pounds.

e. Install detent terminal in stator connector and install stator connector to case connect.

f. Install governor feed pipe in transmission case and control valve body.

NOTE: Make certain that governor feed pipe is seated in bores in case and valve body.

j. Pressure Regulator Valve, Intake Pipe and Strainer Assembly, Bottom Pan, Modulator Valve and Modulator

1. Install Pressure Regulator Valve

a. Install spring retainer on pressure regulator spring. Also install spacers if previously removed, Fig. 7-206.

b. Install pressure regulator valve on spring, stem end first.

c. Install boost valve into bushing, stem end out, and stack parts so that pressure regulator spring is against valve bushing.

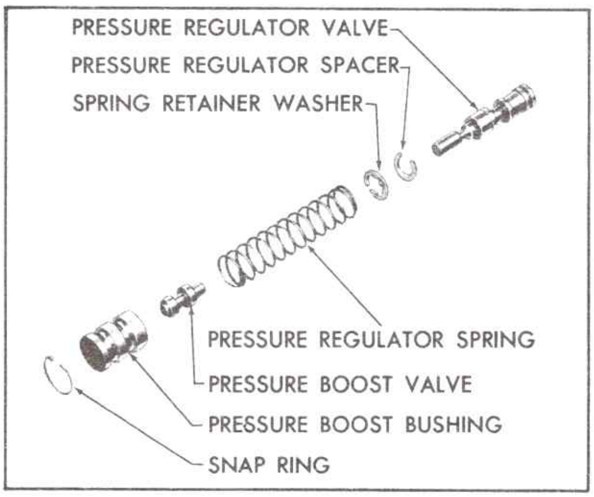


Fig. 7-206 Pressure Regulator Valve Disassembled

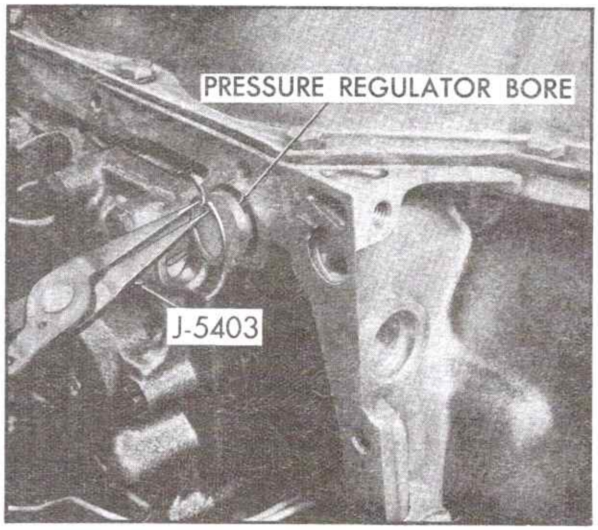


Fig. 7-207 Installing Pressure Regulator Valve

d. Install complete assembly, pressure regulator valve first, into pressure regulator valve bore, being careful not to drop parts during installation.

e. Using a screwdriver or steel rod, compress regulator boost valve bushing against pressure regulator spring until it is beyond snap ring groove, and install snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-207.

NOTE: To facilitate installation of snap ring, encircle it around screwdriver or steel rod, compress tangs with snap ring pliers, and slide snap ring into ring groove in valve bore.

2. Install Intake Pipe and Strainer Assembly and Bottom Pan

a. Install new intake pipe O-ring into pipe bore in transmission case and install intake pipe and strainer assembly.

b. Install new bottom pan gasket on transmission case and install bottom pan.

c. Install 13 bottom pan attaching screws. Tighten screws to 12 foot-pounds.

3. Inspect Vacuum Modulator and Valve

a. Inspect vacuum modulator for any signs of bending or distortion.

b. Inspect O-ring seat for damage.

c. Apply suction to vacuum tube and check for leaks; the presence of red transmission oil in the vacuum section indicates a leak.

d. Inspect modulator valve for nicks or damage.

e. Check freeness of valve operation in case bore.

f. Check modulator for damaged bellows. Modulator plunger is under approximately 16 pounds pressure. If bellows is damaged, plunger will have very little pressure.

4. Install Modulator Valve and Vacuum Modulator

a. Install modulator valve into case with stem end in.

b. Install new O-ring on vacuum modulator.

c. Install vacuum modulator into case with vacuum hose pipe facing stator connector.

d. Install modulator retainer with curved side of tangs inboard and install attaching screw. Tighten screw to 13 foot-pounds.

k. Governor and Speedometer Driven Gear

1. Inspect Governor

NOTE: All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly.

a. Wash all parts in cleaning solvent, air dry and blow out all passages.

b. Inspect governor sleeve for nicks, burrs, scoring or galling.

Fig. 7-208 Installing Governor Assembly

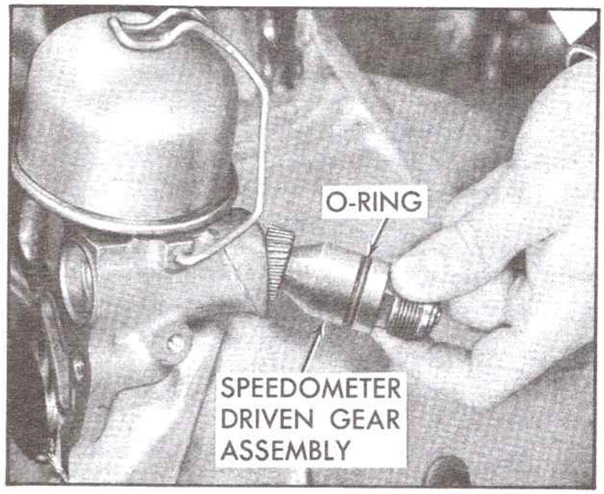


Fig. 7-209 Installing Speedometer Driven Gear Assembly

c. Check governor sleeve for free operation in bore of transmission case.

d. Inspect governor valve for nicks, burrs, scoring or galling.

e. Check governor valve for free operation in bore of governor sleeve.

f. Inspect governor driven gear for nicks, burrs, or damage.

g. Check governor driven gear for looseness on governor sleeve.

h. Inspect governor springs for distortion or damage.

i. Check governor weights for free operation in their retainers.

j. Check valve opening at entry and exhaust (.020 inch minimum).

2. Install Governor

a. Rotate transmission in Holding Fixture Base so that governor bore is up.

b. Install new square cut O-ring seal on governor assembly and install assembly into transmission case, Fig. 7-208.

c. Position retaining clip on top of governor assembly.

3. Inspect Speedometer Driven Gear Assembly

a. Inspect gear for damaged teeth or shaft.

b. Inspect sleeve for scores, damaged threads or cracks.

4. Install Speedometer Driven Gear Assembly

a. Install new O-ring seal on speedometer driven gear assembly.

b. Install speedometer driven gear assembly into transmission case, Fig. 7-209.

c. Position retaining clip to transmission and driven gear assembly and secure with one attaching bolt, tightening bolt to 3 ft. lbs.

I. Converter

1. Inspect Torque Converter

a. Check converter for leaks as described in Note 15.

b. Check converter hub surfaces for signs of scoring or wear.

2. Install Torque Converter

a. Position transmission jack with adapter plate to transmission and install transmission on jack using brace and safety chain.

b. Carefully position converter on turbine shaft, making certain converter is properly aligned. Long screws or eyebolts can be threaded into the weld nuts on the converter and used as handles.

c. Rotate converter until the shafts are piloted and the converter lugs are indexed in the pump gear.

d. If difficulty is experienced in alignment, tap on outer diameter of converter with plastic-headed hammer, while turning converter.

e. Install Converter Holding Clamp, J-21366, on transmission case.

f. Remove Transmission Holding Fixture, J-22240, from transmission.

TORQUE CHART

APPLICATION	FT. LBS.
Transmission to Engine Bolts	25
Torque Converter to Flywheel	30
Flywheel Housing Cover	5
Final Drive to Transmission	25
Starter Motor to Transmission	25
Solenoid to Valve Body	3
Line Pressure Plug	13
Vacuum Modulator Retainer	13
Solenoid to Case	10
Valve Body to Case	8
Center Support to Case	23
Manual Shaft to Inside Lever	18
Pump Body to Cover Rate	20
Parking Brake Bracket to Case	18
Oil Pan to Case	12
Sprocket Housing	8
Support Housing to Cover Plate	20
Speedometer Drive Gear Retainer	3

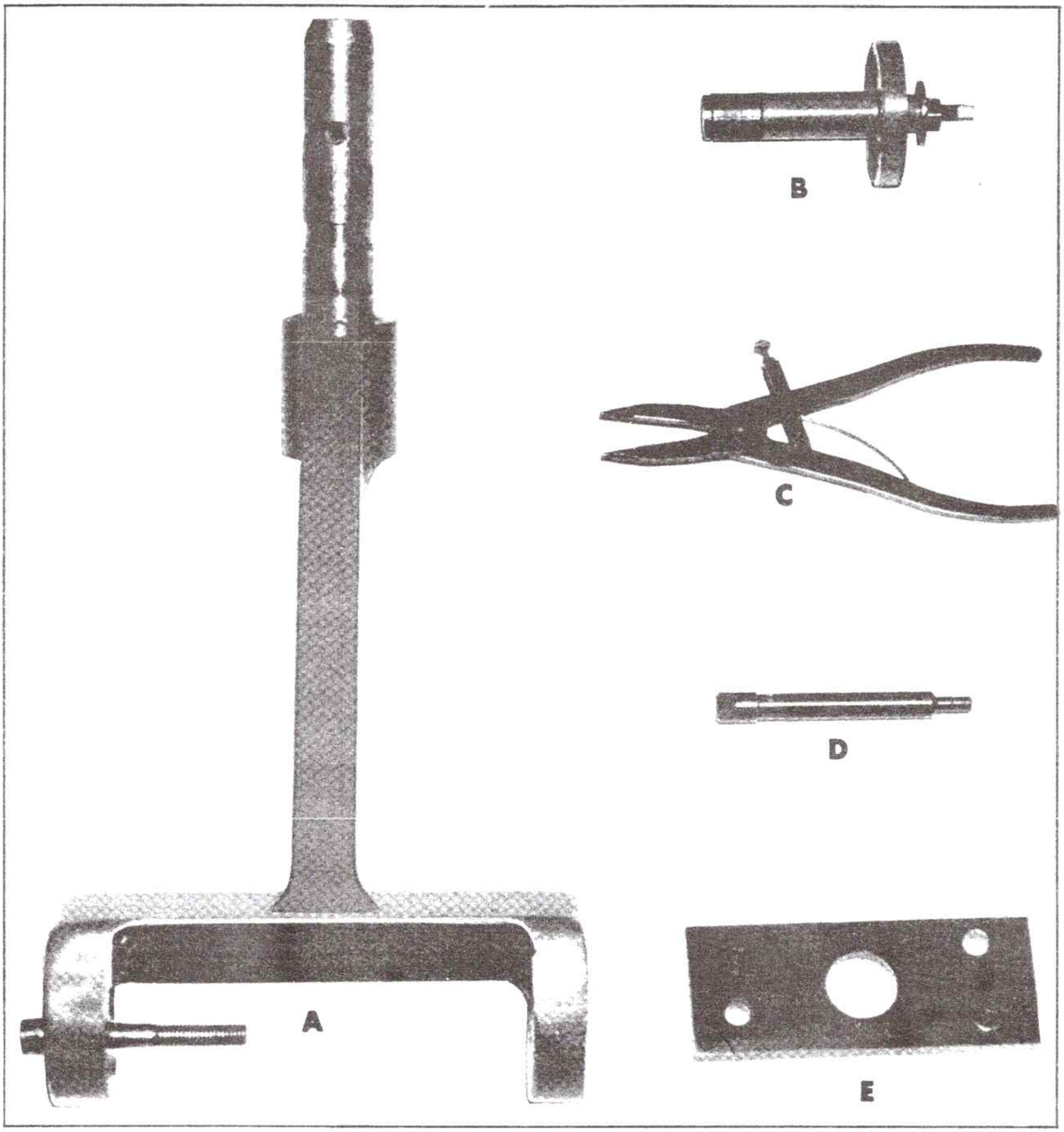


Fig. 7-210 Special Tools

SPECIAL TOOLS

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22240	Transmission Holding Fixture	C	J-4646	Snap Ring Pliers
			D	J-21370-5	Band Apply Gage Pin
B	J-22241	Front Unit End Play Checking Tool	E	J-21370-8	Band Apply Adapter Plate

NOTE: The above Special Tools are required in addition to most tools shown in Fig. 7-106 to properly overhaul the Turbo Hydra-matic transmission used on the Fleetwood Eldorado.

FUEL SYSTEM

GENERAL DESCRIPTION

The fuel tank on all 1967 Cadillac cars is mounted against the lower surface of the trunk compartment with two support straps. This type of mounting allows removal from below without disturbing sheet metal parts.

The fuel tank capacity is approximately 26 US gallons (21.75 Imperial gallons) on all models except the Fleetwood Eldorado, which has a 24 gallon (20 Imperial gallons) capacity fuel tank and Commercial Chassis, which has a 20 gallon (16.75 Imperial gallons) capacity fuel tank.

The gasoline filler cap is located behind the rear license mounting plate, which is the filler door. The hinged plate swings out from the top. The filler pipe is attached to the tank at the rear center through a flexible hose connector. A vent pipe at the front of the tank is used on all models except 693, to allow air to enter the tank as gasoline is used. The filler cap is a NON-VENTED type on all models using the vent pipe located at the front of the tank.

The tank unit for the gasoline gage is mounted near the top center of the fuel tank. It contains the float unit, which is connected to the gage unit on the instrument panel by one wire, with another wire to ground. The fuel outlet line is integral with tank float unit assembly. It has a special plastic filter on the inlet end. The filter has a self-cleaning action, provided by the sloshing action of the gasoline.

The fuel outlet line is attached to the gage assembly on the top center of the tank, and extends along the inside of the right frame side rail to fuel pump, Fig. 8-1.

SERVICE INFORMATION

1. Storage Precautions

Whenever a car is to be put in storage for any length of time, all gasoline should be drained from the entire fuel system, including the carburetor, fuel filter, fuel pump, lines and tank. This must be done to assure freedom from gum deposits that would occur due to evaporation of the fuel.

2. Fuel Tank Removal and Installation

NOTE: When working on or around the fuel tank, always have a CO_2 fire extinguisher near

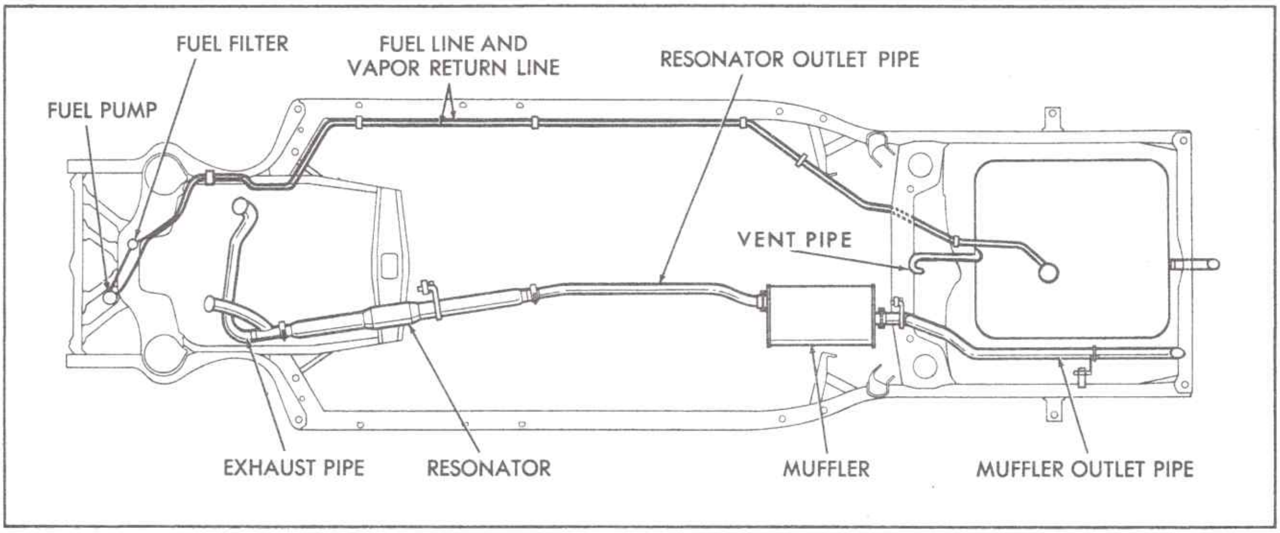


Fig. 8-1 Fuel Tank and Exhaust System (Except 693)

the work area. In addition, do not permit any smoking, open fire, or work of a nature that could produce a spark in the area.

a. Removal

1. Disconnect fuel gage tank wire at connector at right of filler cap behind license plate door. This is the brown wire to the lower connector. Pull wire down past rear frame member from underside of car.

2. Raise rear end of car.

3. Siphon fuel from tank.

4. Loosen clamp at lower end of filler pipe flexible hose connector.

5. Remove bolt from support bracket of filler pipe and remove filler pipe through opening between bumper and rear end of frame.

6. Disconnect fuel outlet hose at front of tank.

7. If car is equipped with air conditioning, disconnect vapor return hose.

8. Disconnect vent from rear suspension cross member.

9. Disconnect fuel gage tank unit ground wire at rear frame cross member.

10. Remove tank support strap nuts and remove tank.

CAUTION: Be careful tank does not damage or dent brake piping on axle housing.

b. Installation

1. Raise tank into position and install tank support straps and nuts. Make sure fuel gage tank unit wire and ground wire hang over tank.

NOTE: Do not tighten tank strap nuts until filler pipe is installed.

2. Position filler pipe in place and tighten clamp on end of hose connector.

3. Install bolt in support bracket on top of filler pipe.

4. Tighten tank strap nuts until 1 1/2 inch to 1 9/16 inch of thread is exposed on bottom of J-bolts. On Fleetwood Seventy-Fives, run nut below notch and break off notched end of J-bolt. Be careful not to overtighten tank strap nuts.

5. Connect fuel outlet hose.

6. If car is equipped with air conditioning, connect vapor return pipe.

7. Connect vent to rear suspension cross member.

8. Route brown fuel gage tank unit wire over rear cross member and up to right of filler pipe. Secure to lower right connector.

9. Connect tank unit ground wire to frame.

10. Lower car, add gasoline to tank, and check for leaks at filler pipe, vent pipe, fuel line, and vapor return line.

11. Check operation of fuel gage.

3. Fuel Line and Tank Cleaning

Occasionally it may be necessary to clean out fuel line and tank to remove foreign particles from system. Frequent replacement of fuel filters and excessive deposits of dirt in filter bowl are indications that this may be necessary.

To clean out fuel line, disconnect line at fuel pump and at fuel tank, blow compressed air through the line in direction opposite to fuel flow, and reconnect line.

For cleaning, fuel tank must be removed from car, and flushed out to remove all foreign materials. Fuel strainer also should be inspected and replaced if necessary.

4. Fuel Line

NOTE: When working on or around the fuel lines, always have a CO_2 fire extinguisher near the work area. In addition, do not permit any smoking, open fire, or work of a nature that could produce sparks in the area.

a. Removal

1. Raise rear end of car.

2. Remove three clips that secure fuel line to inside of right frame side rail, one clip at frame where it ramps upward at front and one clip on body where line ramps upwards at rear. A dual clip is used to hold fuel and vapor return lines.

3. Remove hose clamps, one at front of, and one at rear of, fuel line. Remove fuel line from flexible hoses.

4. Plug flexible hoses to prevent fuel loss.

b. Installation

1. Unplug flexible hoses.

2. Position fuel line, connect flexible hoses, and install hose clamps.

3. Install three clips along inside of frame member, one clip at frame where it ramps upward at front and one clip on body where lines ramp upward at rear. If car is equipped with air conditioning, larger diameter fuel line should be installed above and vapor return line below, along frame side rail.

4. Check both fuel line connections.

5. Check flexible hoses for stabilizer bar clearance at front, and for axle clearance at rear.

EXHAUST SYSTEM

GENERAL DESCRIPTION

The exhaust system on all 1967 Cadillac cars, except the 693, incorporates (in order, from front to rear) a crossover Y- exhaust pipe, a coaxial resonator, a resonator outlet pipe, a muffler and a muffler outlet pipe, Fig. 8-1. On the Sixty-Special and Fleetwood Seventy-Five Series, a longer resonator outlet pipe is used because of the additional length of these vehicles.

The exhaust system on the Commercial Chassis is basically similiar, except for the use of a two-section resonator outlet pipe.

The components of the 1967 exhaust system are supported by slide and blade-type hangers, clamps, and brackets, and are insulated at attaching points by rubber cushions. These supports are designed to keep the system in proper alignment to avoid contact with the frame and body, even when the system is hot and expanded. The system must not be bound up or restricted if the noise reduction benefits are to be fully realized.

The thermostatically controlled heat valve is located at the junction of the right exhaust manifold and exhaust pipe. It controls the flow of exhaust gases from the right cylinder head. During the engine warmup period, the valve is closed, forcing the hot exhaust gases through a ribbed heat passage in the intake manifold to heat the intake air-fuel mixture.

A branch of this passage conducts exhaust gases up to the carburetor. These hot gases warm the carburetor in the region of the primary throttle valves and idle ports to prevent stalling due to ice formation during engine warm-up on cool, humid days. Better performance and economy are thereby provided when the engine is cold.

SERVICE INFORMATION

5. Muffler Outlet Pipe Removal and Installation

NOTE: Do not use acetylene torch behind rear axle due to presence of fuel tank fumes.

a. Removal

1. Raise rear end of car.

2. Remove rearmost clamp and hanger blade securing outlet pipe to support bracket at frame side rail, Fig. 8-2.

3. Loosen or remove clamp securing outlet pipe to muffler.

4. Remove clamp and hanger blade at support bracket located above rear axle at "kick-up" area, Fig. 8-3.

CAUTION: Muffler and outlet pipe will sag. Be careful outlet pipe does not damage or dent brake piping on axle housing.

Support system with jack stands as required.

5. Remove outlet pipe from muffler, using heat if required.

CAUTION: Have a CO_2 fire extinguisher near the work area.

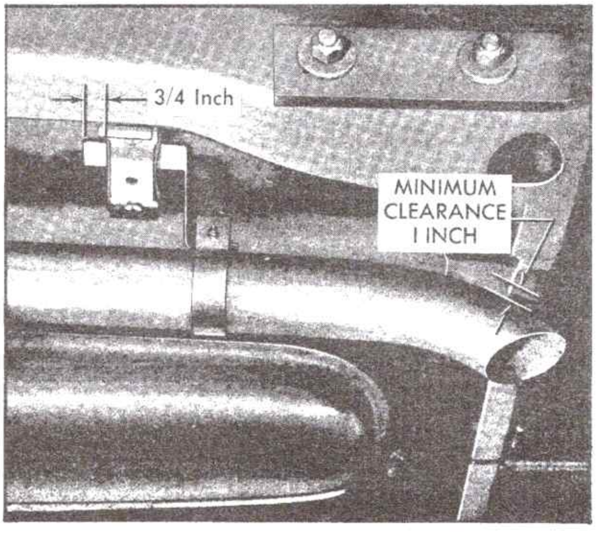


Fig. 8-2 Muffler Outlet Pipe Hanger at Frame

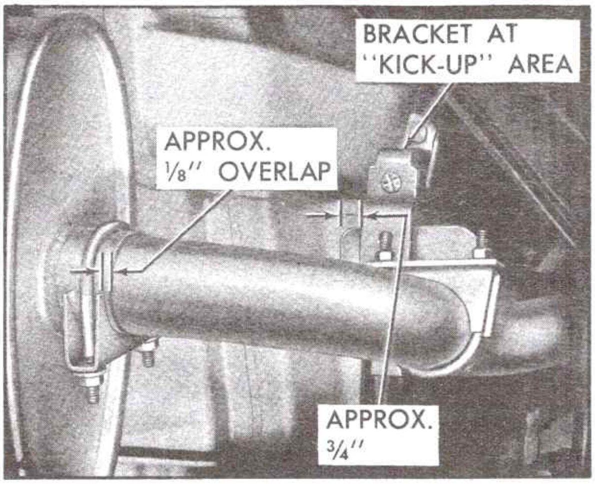


Fig. 8-3 Muffler Outlet Pipe at Kick Up Area

b. Installation

1. Install muffler outlet pipe in muffler so that there is approximately 1-5/8 inch overlap of pipes.

NOTE: Before installation scribe a line 1-5/8 inch from end of outlet pipe to aid in determining amount of overlap.

2. Loosely install clamp and blade in support bracket located above rear axle area.

3. Loosely install clamp to secure muffler to outlet pipe so that there is approximately 1/8 inch between saddle of clamp and edge of muffler pipe.

4. Loosely install rearmost clamp and blade at support bracket at frame side rail.

NOTE: Align pipe so that there is a minimum of 1 inch between outlet and rear frame cross member, when measured perpendicular to the angle of pipe at outlet, Fig. 8-2.

5. Tighten all clamps and brackets.

6. Remove jack stands and lower car.

6. Muffler Removal and Installation

NOTE: When using heat, have a CO_2 fire extinguisher near the work area.

a. Removal

1. Raise car on hoist or jack stands.

2. Remove clamp at rear of muffler that secures muffler to outlet pipe. If same muffler is to be installed, note position of clamp carefully for installation purposes.

3. Using heat as required, pry muffler outlet pipe rearward.

CAUTION: Outlet pipe and muffler will sag when hanger blades for outlet pipe slide rearward out of rubber slots in brackets. Be careful that outlet pipe does not damage or dent brake piping on axle housing. Support system with jack stands or on floor.

4. If same muffler is to be reinstalled, note position of clamp at front of muffler, then remove clamp or loosen enough to slide clamp out of way.

5. Work muffler loose from resonator outlet (intermediate) pipe. Use heat as required. Remove muffler.

b. Installation

1. Position muffler on resonator outlet (intermediate) pipe, and work muffler forward to obtain an overlap of pipe ends of approximately 1-5/8 inches.

2. Position muffler outlet pipe so that hanger blades will slide into rubber slots in brackets, then install outlet pipe in end of muffler to obtain an overlap of pipe ends of approximately 1-5/8 inches. Before installation, scribe a line 1-5/8 inches from end of outlet pipe to aid in determining amount of overlap of pipes. Use jack stands to support muffler and pipe as required.

3. Install U-bolt and clamp loosely at front of muffler. Position clamp so there is approximately 1/8 inch between saddle of clamp and edge of muffler pipe, Fig. 8-4.

4. If muffler that was removed is being installed, clamp must be in exact same position as when previously installed. Install clamp at rear

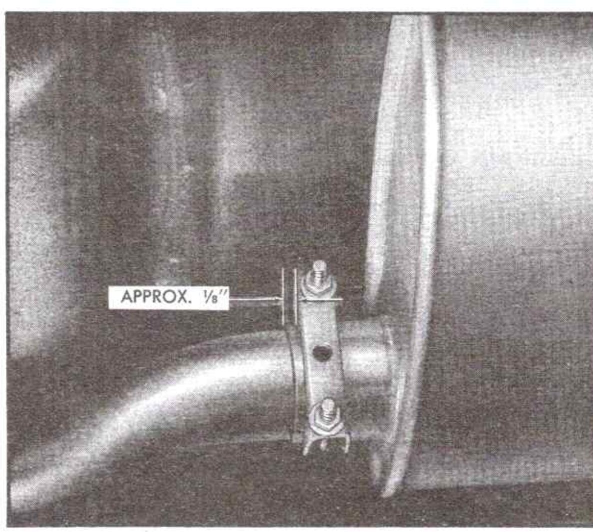


Fig. 8-4 Resonator Outlet Pipe Clamp at Muffler

of muffler. Position clamp so there is approximately 1/8 inch between saddle of clamp and edge of muffler pipe.

5. Install rearmost clamp and blade at frame side member.

6. Tighten all clamps, and remove any jack stands used.

7. Lower car.

7. Resonator Outlet (Intermediate) Pipe Removal and Installation

NOTE: Have a CO_2 fire extinguisher near the work area when using heat.

a. Removal

1. Remove muffler as outlined in Note 6a.

2. Remove clamp at front end of resonator outlet (intermediate) pipe.

3. Remove screw at rear of resonator.

4. Using heat as required, separate resonator outlet pipe from resonator, and remove resonator outlet pipe. On Commercial Chassis, remove two sections of resonator outlet pipe.

b. Installation

1. Position resonator outlet pipe onto resonator with an overlap of 1-1/2 inches.

2. Install screw at rear of resonator, using sealer.

3. Install clamp loosely at front of resonator outlet pipe. There should be approximately 1/8 inch between front edge of resonator outlet pipe and saddle of clamp.

4. Install muffler as outlined in Note 6b, but align system from resonator outlet pipe rearward before tightening clamps.

8. Resonator Removal and Installation

a. Removal

1. Remove clamp at rear of resonator.

2. Remove screw at rear of resonator.

3. Using heat as required, work resonator outlet (intermediate) pipe, muffler, and muffler outlet pipe rearward as a unit, until support blades slide from rubber slots in brackets.

CAUTION: Resonator outlet pipe, muffler and muffler outlet pipe will drop. Support with jack stands or on floor.

Be careful system does not damage or dent brake piping on axle housing.

4. Pry muffler and resonator outlet pipe rearward from resonator. Use heat as required. Lower muffler outlet pipe over rear axle, and lower muffler and resonator outlet pipe to stand on floor.

5. Loosen clamp at front of resonator.

6. Pry resonator rearward with a "rocking" motion, using heat if required.

7. Slide hanger blade out of slot in support bracket and remove resonator.

b. Installation

1. Position resonator on exhaust pipe, allowing approximately 1-3/8 inches overlap of resonator with exhaust pipe; at the same time slide blade into hanger slot at transmission extension housing bracket, allowing blade to protrude from front of hanger slot about 3/4 inch, Fig. 8-5.

2. Install resonator front clamp. See Fig. 8-6.

3. With aid of a helper, raise resonator outlet pipe, muffler and muffler outlet pipe as a unit and install resonator outlet pipe onto resonator end; at the same time, slide hanger blades into rubber slots in support bracket at "kick-up" area and at side frame member.

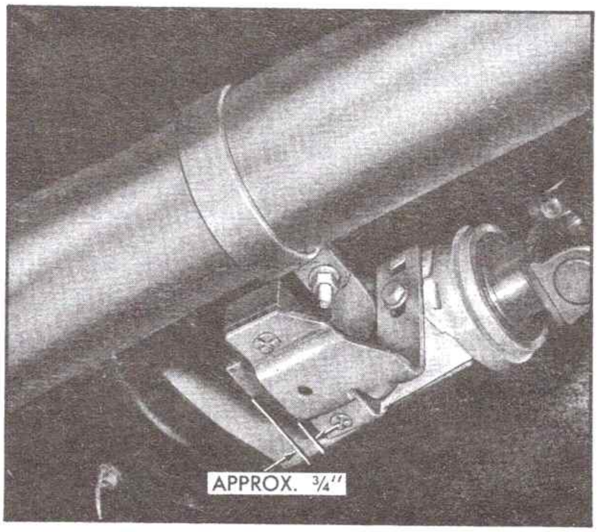


Fig. 8-5 Resonator Hanger at Transmission

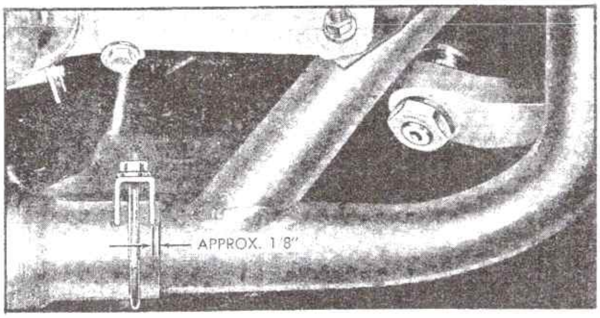


Fig. 8-6 Resonator Exhaust (Y) Pipe Clamp

4. Install resonator rear clamp at resonator outlet pipe.

NOTE: This is a special "U" -type clamp that must be used for properly securing the installation.

5. Using sealer, install screw at rear of resonator.

6. Align system as necessary, and tighten all clamps.

NOTE: A higher torque is required on the resonator clamp than on other clamps.

7. Check system for grounding.

9. Exhaust Pipe ("Y" Pipe) Removal and Installation

NOTE: Have a CO_2 fire extinguisher near the work area when using heat.

a. Removal

1. Raise car on hoist or jack stands.

2. Remove resonator as described in Note 8a.

NOTE: In some cases where exhaust pipe and resonator are fairly new, it may be possible to remove exhaust pipe without removing resonator. This is done after performing step 3 below by simply rotating exhaust pipe approximately 1/4 turn from right side and working pipe forward from resonator front end.

3. Using a long-extension wrench, remove two special nuts from right exhaust manifold studs, then remove two special nuts from left exhaust manifold studs.

4. Lower exhaust pipe and remove heat control valve.

b. Installation

1. Install heat control valve on right exhaust manifold locating studs. Face of valve stamped "TOP" must be next to manifold.

2. Install resonator front end on exhaust pipe, using heat as required. Let pipes cool.

NOTE: If resonator was removed, install exhaust pipe first, then refer to Note 8b for installation of resonator.

3. Install two special nuts on left and on right manifolds, torquing nuts evenly to 33 foot-pounds.

4. Position clamp on front end of resonator, as specified in Fig. 8-6, and tighten securely.

5. Inspect entire exhaust system for proper alignment. Refer to Note 11. Make corrections as required, or align entire system.

6. Lower car.

10. Heat Control Valve Removal and Installation

a. Removal

1. Raise front end of car.

2. Remove two nuts securing left exhaust pipe to manifold locating studs.

3. Remove two nuts securing right exhaust pipe to locating studs.

4. Remove resonator hanger at transmission.

5. Lower exhaust pipe slightly and remove heat control valve.

b. Installation

1. Install heat control valve on right exhaust manifold locating studs. Be sure face of valve stamped "TOP" is next to manifold.

2. Install right side of exhaust pipe and tighten two special nuts to 33 foot-pounds.

3. Install left side of exhaust pipe on locating studs and tighten two special nuts to 33 foot-pounds.

4. Install resonator hanger at transmission.

5. Lower car.

11. Exhaust System Alignment

NOTE: When preparing to align exhaust system, be sure it is cold and not expanded. Exhaust system should be properly aligned to avoid contact with frame. Blade-type exhaust system hangers are designed to minimize noise transfer through hangers. If system contacts frame or blade is bound up or restricted, vibration and noise can be transmitted into car.

Position clamps and blades so that hanger blades are horizontal and centered from side to side in the rubber slots of the support brackets. The support brackets should be horizontal also. A light coat of silicone should be applied in rubber slots of brackets.

If it is necessary to reposition pipes, heat may be used in front of rear axle. Allow pipes to cool before touching them. Do not use acetylene torch behind rear axle due to presence of fuel tank fumes. Have CO_2 fire extinguisher near the work area.

1. Raise car on hoist or jack stands.

2. Loosen clamps located at resonator ends, muffler ends, clamp and blade at transmission extension housing, "kick-up" area and left side frame member.

3. Make certain resonator is horizontal and has adequate clearance at transmission mounting support. At the transmission extension housing hanger, Fig. 8-5, the blade should be centered from side to side and horizontal in rubber slot of support hanger. It must not bind when system expands. The resonator support blade should be parallel with the transmission housing bracket. Support hanger should be horizontal. A small amount of silicone lubricant should be in rubber slot of the hanger. End of blade should protrude approximately 3/4 inch from bracket, Fig. 8-5.

4. Position resonator front clamp at an angle of approximately 35° inboard to car so there is approximately 1/8 inch between saddle of clamp and edge of resonator pipe, Fig. 8-6. Tighten clamp to 50 foot-pounds.

5. Position clamp between resonator outlet pipe and muffler so there is approximately 1/8 inch between edge of resonator outlet pipe and saddle of clamp, Fig. 8-4. Tighten clamp just enough to prevent separation. Then check alignment of remainder of exhaust system.

6. Position clamp between muffler outlet pipe and muffler so there is approximately 1/8 inch between edge of muffler and saddle of clamp.

There should be approximately 1-5/8 inch overlap of outlet pipe with muffler pipe.

7. Align outlet pipe so there is a minimum of one inch between outlet pipe and rear frame cross member, when measured perpendicular to the angle of pipe at outlet, Fig. 8-2.

8. Check entire system again to see that there is adequate clearance with frame and body members, at least one inch. The weight of the exhaust system should be evenly distributed on all brackets and hangers as indicated by an equal deflection at each hanger. If the load is not properly balanced, reposition the pipes at the joints to relieve concentrated loads on any hangers.

9. After adjusting hangers or repositioning pipes, recheck the entire system for adequate clearance to frame members and tighten all clamps according to torques specified at the end of this section.

10. Lower car.

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot-Pounds
Special	Exhaust Pipe to Manifold Nuts	3/8 -24	33
286-M	Muffler and Resonator Clamp Nuts	5/16-18	20
301-M	Exhaust Pipe to Resonator Clamp Nuts	3/8 -16	50
	Resonator Support to Transmission Screw	3/8-16 x 7/8	35
NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.			

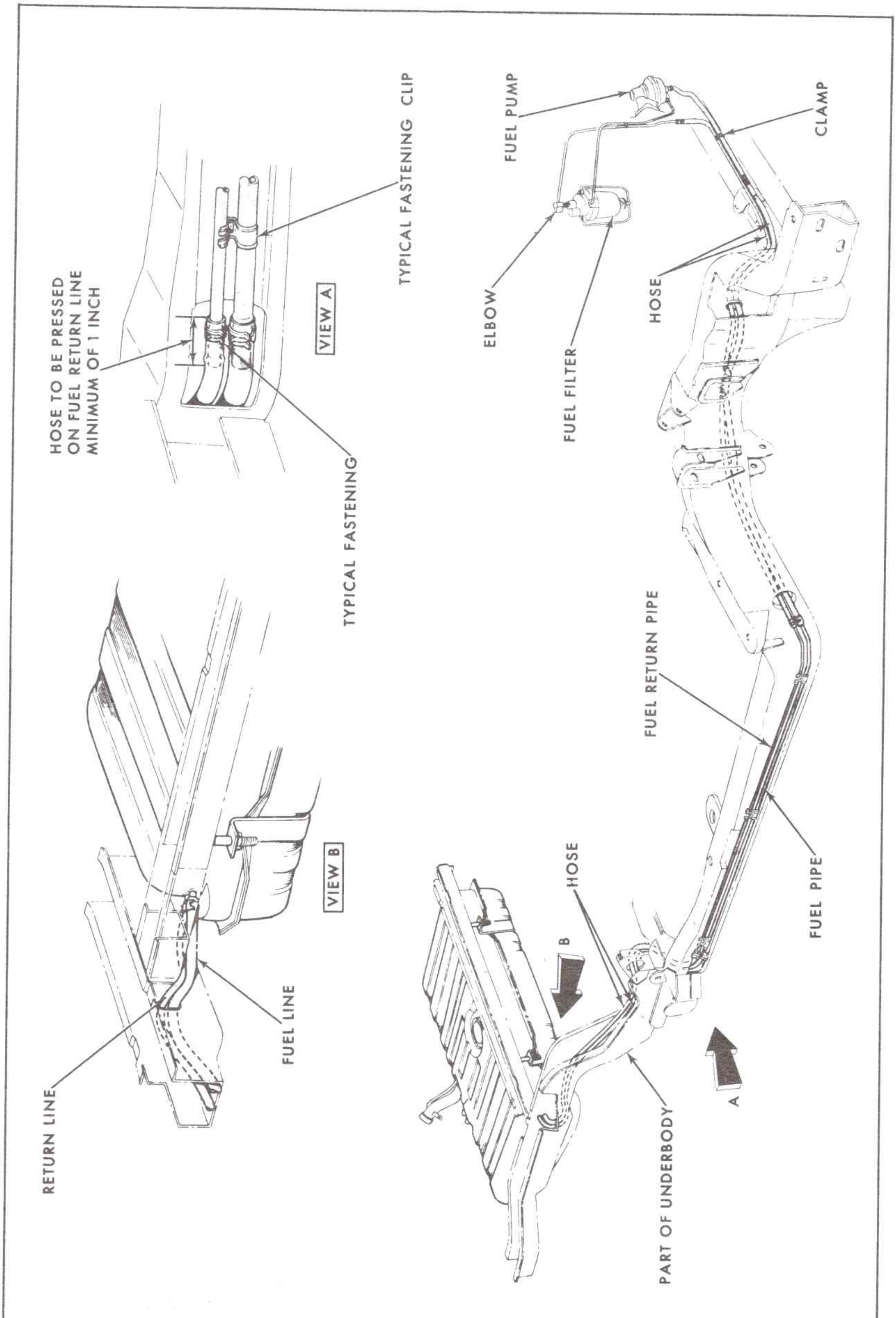


Fig. 8-7 Fuel System (693)

FUEL SYSTEM

DESCRIPTION

The fuel tank on the 1967 Fleetwood Eldorado coupe Fig. 8-7, is mounted against the lower surface of the trunk compartment with two support straps the capacity of this fuel tank is approximately 24 U. S. gallons (20 Imperial gallons).

The gasoline filler cap is accessible through a fuel filler door located at the center of the lower edge of the deck lid. This door swings upward from the bottom. The filler pipe is attached to the tank at the rear center through a flexible hose. The vent pipe is located next to the filler pipe and connects into the filler pipe just below the cap. A VENTED cap is used on this model to allow air to enter the tank as gasoline is used.

SERVICE INFORMATION

12. Fuel Tank Removal and Installation (693)

NOTE: When working on or around the fuel tank, always have a CO_2 fire extinguisher near work area. In addition, do not permit any smoking, open fire, or work of a nature that could produce sparks in the area.

a. Removal

1. Open trunk and remove eight screws securing filler panel and remove filler panel.

2. Disconnect fuel gage tank wire behind rear bumper.

This is the brown wire to connector at rear of body. Pull wire down under car.

3. Raise rear of car and place on jack stands.

4. Syphon fuel from tank.

5. Loosen clamp at lower ends of filler pipe and vent pipe flexible connectors.

6. Remove bolt from filler pipe support bracket and remove filler pipe from behind filler door.

7. Disconnect fuel outlet hose at front of tank.

8. If car is equipped with air conditioning, disconnect vapor return hose at front of tank.

9. Remove fuel gage tank unit ground wire at rear body cross member.

10. Remove tank support strap nuts and remove tank.

CAUTION: Be careful tank does not damage muffler or resonator.

b. Installation

1. Raise tank into position and install tank support straps and nuts. Make sure fuel gage tank unit wire and ground wire hang over tank.

NOTE: Do not tighten tank strap nuts until filler pipe is installed.

2. Position filler pipe in place and tighten clamps and ends of hose connector.

3. Install bolt in support bracket on top of filler pipe.

4. Tighten tank strap nuts to 10 foot-pounds.

5. Connect fuel outlet hose.

6. If car is equipped with air conditioning, connect vapor return line.

7. Route brown wire up to connector at back of body and install it in connector.

8. Connect tank unit ground wire to rear body cross member.

9. Remove jack stands, lower car, add gasoline to tank, and check for leaks at filler pipe, vent pipe, fuel line, and vapor return line.

10. Check operation of fuel gage.

11. Install filler panel and secure with eight screws.

13. Fuel Line

NOTE: When working on or around the fuel lines, always have a CO_2 fire extinguisher near the work area. In addition, do not permit any smoking, open fire, or work of a nature that could produce sparks in the area.

a. Removal

1. Raise car.

2. Remove clamps securing flexible fuel line to fuel tank outlet and to fuel pump, and disconnect lines at these points.

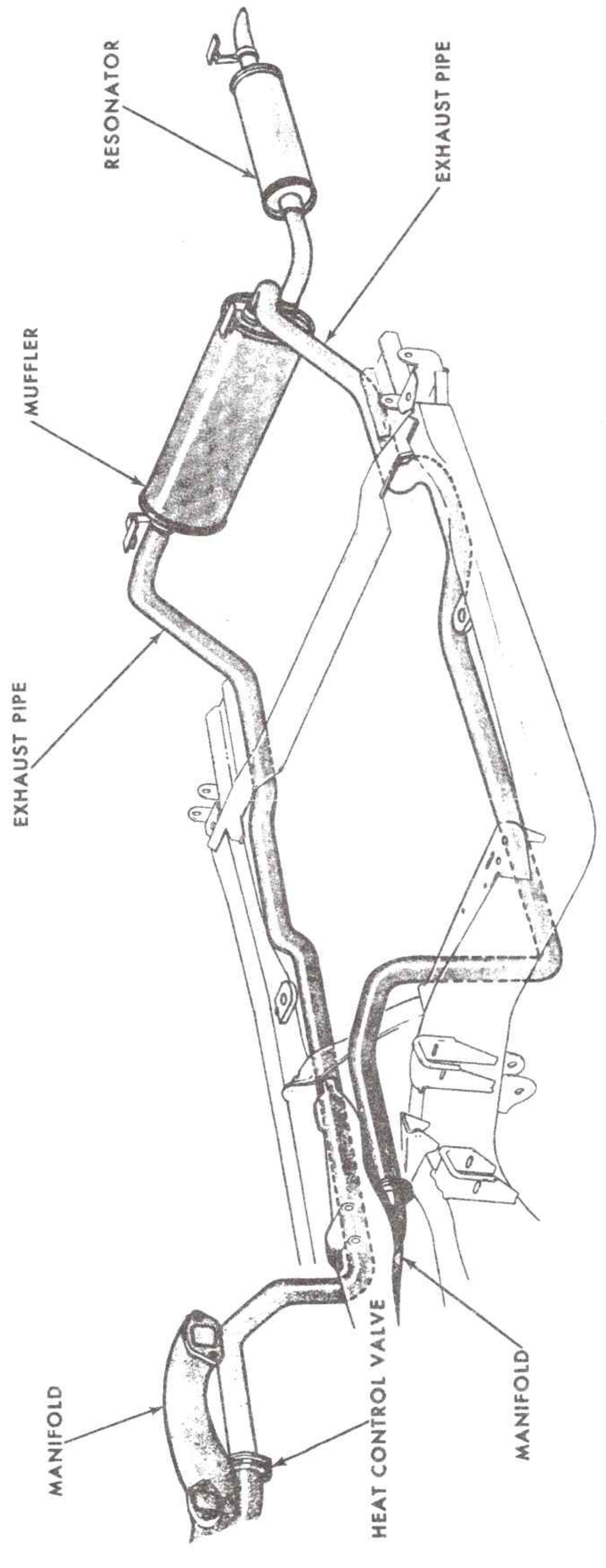


Fig. 8-8 Exhaust System (693)

3. Tie a piece of cord to the flexible fuel lines for installation purposes.

4. Remove three clips securing fuel line to outside surface of right frame side rail.

5. Carefully remove fuel lines from car, leaving cord in place on car.

6. Remove clamps securing flexible fuel line to fuel pipe and separate.

b. Installation

1. Connect flexible fuel line to steel fuel pipe and secure with clamps. Hoses should overlap steel line one inch.

2. Position fuel pipe to outside surface of right frame side rail and secure with three clips.

3. Tie cords left in car to ends of flexible fuel lines and carefully pull fuel lines to tank and engine.

4. Remove cord.

5. Connect flexible lines at tank and engine and secure with clamps.

6. Lower car.

EXHAUST SYSTEM

DESCRIPTION

The exhaust system on the 693 body style, Fig. 8-8, consists of two exhaust pipes, a muffler, and a resonator. The system is supported to the rear body by blade-type hangers at three points; two where the exhaust pipes enter either end of the muffler and one on the resonator outlet. The forward portion of the system is supported by its connection to the exhaust manifolds.

SERVICE INFORMATION

14. Exhaust Pipe

a. Removal

1. Loosen clamp securing exhaust pipe to muffler.

2. Drive exhaust pipe out of muffler.

3. Cut exhaust pipe at weld in pipe and remove rear portion of pipe.

4. Remove two screws securing left pipe flange to manifold or two nuts securing right pipe flange to manifold.

5. Remove forward portion of pipe, exercising care not to drop manifold heat valve if right side is being removed.

6. Remove manifold heat valve if right side pipe was removed.

b. Installation

1. Position pipe and flange to manifold and loosely install retaining screws, left side, or nuts, right side. The manifold heat valve should be positioned between pipe flange and manifold on right side only.

2. Position pipe clamp loosely around forward portion of pipe.

3. Insert rear portion of pipe into forward portion of pipe so that pipes overlap up to the dimple on the pipe, approximately 1-1/2 inches. Loosely install clamp with saddle of clamp outboard of system and 1/8" between saddle of clamp and edge of pipe.

4. Insert rear end of pipe into muffler so that muffler overlaps pipe up to the dimple on the pipe, approximately 1-1/2 inches.

5. Align system as described in Note 17.

15. Resonator

NOTE: Do not use acetylene torch behind rear axle due to presence of fuel tank fumes.

a. Removal

1. Raise rear end of car and place on jack stands.

2. Remove clamp securing resonator inlet at muffler.

3. Remove screws securing resonator outlet hanger to body and remove hanger.

4. Remove resonator assembly by driving inlet out of muffler.

5. Remove resonator hanger blade from resonator outlet pipe.

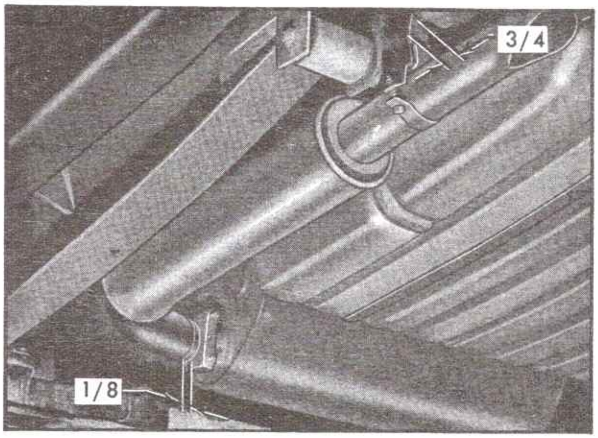


Fig. 8-9 Resonator (693)

b. Installation

1. Loosely install resonator hanger blade on resonator outlet.

2. Position resonator inlet into muffler outlet so that muffler overlaps resonator inlet up to the dimple, approximately 1-1/2 inches overlap.

3. Position resonator outlet hanger on blade and secure hanger to body with screws, Fig. 8-9.

4. Position clamp on joint of resonator inlet and muffler outlet with saddle of clamp 1/8 inch from end of muffler outlet, Fig. 8-9.

5. Align rear portion of exhaust system as described in Note 17.

16. Muffler

NOTE: Do not use acetylene torch behind rear axle due to presence of fuel tank fumes.

a. Removal

1. Raise rear of car and place on jack stands.

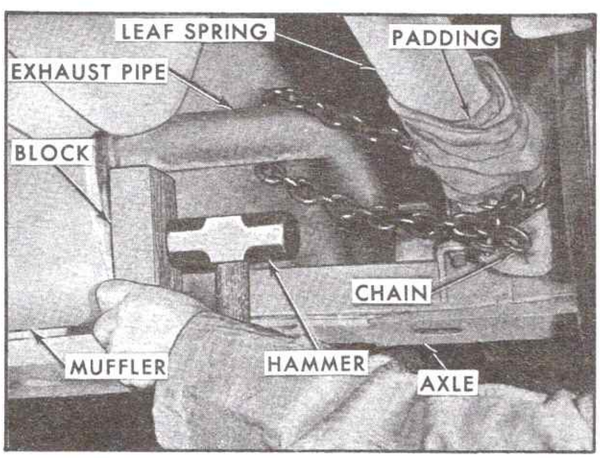


Fig. 8-10 Muffler Removal (693)

2. Loosen clamp securing resonator inlet at muffler.

3. Remove screws securing resonator hanger to body and remove hanger.

4. Remove resonator assembly.

5. Remove right exhaust pipe to muffler clamp and hanger.

6. Remove left exhaust pipe to muffler clamp and hanger, and carefully lower muffler straight downward until exhaust pipes rest on rear axle.

CAUTION: Care should be taken not to damage brake piping or air leveling components on the axle.

7. Secure right exhaust pipe to leaf spring in such a manner that system cannot shift to the left, Fig. 8-10.

CAUTION: The spring should be padded to protect it from damage.

8. Drive muffler off right exhaust pipe.

9. Repeat steps 7 and 8 on the left side.

b. Installation

1. Position left exhaust pipe into muffler up to the dimple on the pipe, approximately 1-1/2 inch overlap of pipes.

2. Position right exhaust pipe into muffler up to the dimple on the pipe, approximately 1-1/2 inch overlap of pipes.

3. Position right exhaust pipe to muffler clamp so there is 1/8 inch between saddle of clamp and muffler.

4. Connect right exhaust clamp to hanger blade and loosely install nuts.

5. Repeat steps 3 and 4 for left clamp and hanger.

6. Position resonator inlet into muffler up to the dimple on the resonator inlet, approximately 1-1/2 inch overlap of pipes.

7. Position resonator hanger blade in its slot and secure hanger to body with screws, Fig. 8-9.

8. Install muffler to resonator clamp at muffler, Fig. 8-9.

9. Align system as described in Note 17.

17. Alignment

NOTE: When preparing to align the exhaust system, be sure it is cold and not expanded.

The exhaust system should be properly aligned to avoid contact with frame or body. The blade type exhaust system hangers are designed to minimize noise transfer through hangers. If system contacts frame or blade is bound up or restricted, vibration and noise can be transmitted into car.

Position clamps and blades so that hanger blades are horizontal and centered from side to side in rubber slots of the support brackets. The support brackets should be horizontal also. A light coat of silicone should be applied in rubber slots of brackets. The hangers must not bind when exhaust system expands.

1. Raise car on hoist or place on jack stands.

2. Loosen clamps located at muffler ends.

3. Check muffler hangers. Ends of hangers should protrude 3/4" from brackets. The muffler should overlap all pipes up to the dimples on the pipes, 1-1/2". The clamps should be positioned with 1/8" between the saddle of clamps and muffler pipes.

4. Make certain that resonator is horizontal and that it has a minimum of 3/4" clearance from fuel tank and 7/8" clearance from rear leaf spring. The resonator outlet hanger blade should be centered from side to side and horizontal in rubber slot of support hanger. It must not bind when system expands. A small amount of silicone lubricant should be in rubber slot of hanger. Blade of hanger should protrude 3/4" from bracket, Fig. 8-9.

5. The entire system should be checked to see that there is adequate clearance to frame and body members, at least 13/16 inch. The weight of the system should be evenly distributed on all three brackets and hangers as indicated by an equal deflection at each hanger. If load is not properly balanced, reposition the pipes at the joints to relieve any concentrated loads.

6. After adjusting hangers or repositioning pipes, recheck entire system for adequate clearance and tighten all clamps according to torques specified at the end of this section.

7. Lower car.

TORQUE SPECIFICATIONS (693 ONLY)

Material Number	Application	Thread Size	Foot-Pounds
Special	Exhaust Pipe to Manifold Nuts	3/8 -24	33
286-M	Clamp Attaching Nuts	5/16-18	20

GENERAL DESCRIPTION

The power steering system used on 1967 Cadillac cars utilizes a variable ratio steering gear (16:1 on center, 11.5:1 at full turn). The Fleetwood Seventy-Five Sedans, Limousines and commercial vehicles use a constant ratio gear (17.5:1).

The steering gear is mounted on the left frame side rail and is secured by three mounting screws. The gear is joined to the steering shaft by a flexible coupling that reduces the transmission of hydraulic valve noises and road shock to the car interior.

A constant displacement vane type pump provides hydraulic pressure for the steering system.

The pump is located on the left front corner of the engine, Fig. 9-1. It is attached to the engine by a rear mounting bracket only, and is belt driven by an engine crankshaft pulley.

On cars equipped with air conditioning, one belt is used on the power steering pump pulley. On cars without air conditioning, two belts are used. These belts assure sufficient belt wrap and grip to drive the water pump and fan (which also carries generator load) under all operating conditions.

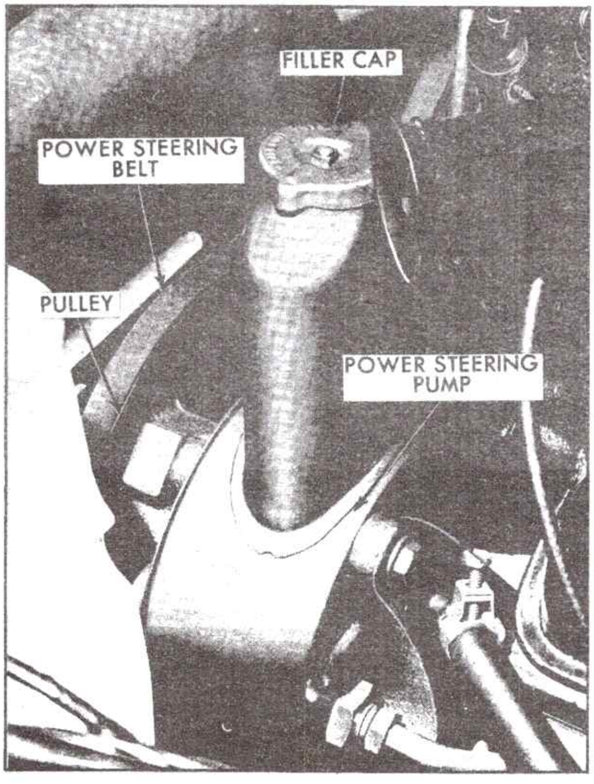


Fig. 9-1 Steering Pump Location

A power steering pump cooler is used on 1967 cars equipped with air conditioning. The cooler compensates for the slightly higher temperatures on air conditioner equipped cars and protects the rubber components of the system from excessive temperatures under extreme operating conditions.

The steering pump cooler is located on the left fender dust shield near the rear of the dust shield.

Steering Linkage

The steering linkage, Fig. 9-2, consists of a pitman arm, idler arm and bracket, two tie rod assemblies, and a one-piece forged steel drag link. The pitman arm connects the left side of the drag link to the steering gear and the idler arm and bracket assembly connect the right side of the drag link to the frame. The tie rods serve as connecting links between the drag link and steering arms.

The tie rod adjuster tubes are lubricated at assembly to make toe-in adjustment easier during front wheel alignment. The adjuster tubes should be re-lubricated with chassis lubricant if disassembled from the tie rods for any reason. Lubrication of the adjuster tube also helps prevent damage to the tie rod pivot seals.

During toe-in adjustment, care must be taken not to bottom out the tie rod pivots, as the seals could be damaged by being pinched between the stud and socket. If this should occur, the entire pivot must be replaced.

Steering Gear

The major internal components of the variable ratio steering gear are the rotary valve assembly, steering worm, rack-piston assembly, and the pitman shaft, Fig. 9-3. The movement of these parts, while turning or parking, is aided by hydraulic fluid supplied by the pump. Manual steering is always available at times when the engine is not running, or in the event of pump failure. Steering effort is increased under such conditions.

The steering input shaft, hydraulic valve, worm shaft, and rack-piston assembly are all "In line". The rack-piston in the variable ratio steering gear is modified to accommodate the larger center tooth on the pitman shaft gear, insert Fig. 9-3. All oil passages are internal within the gear housing, except for the pressure and return hoses between the gear and the pump.

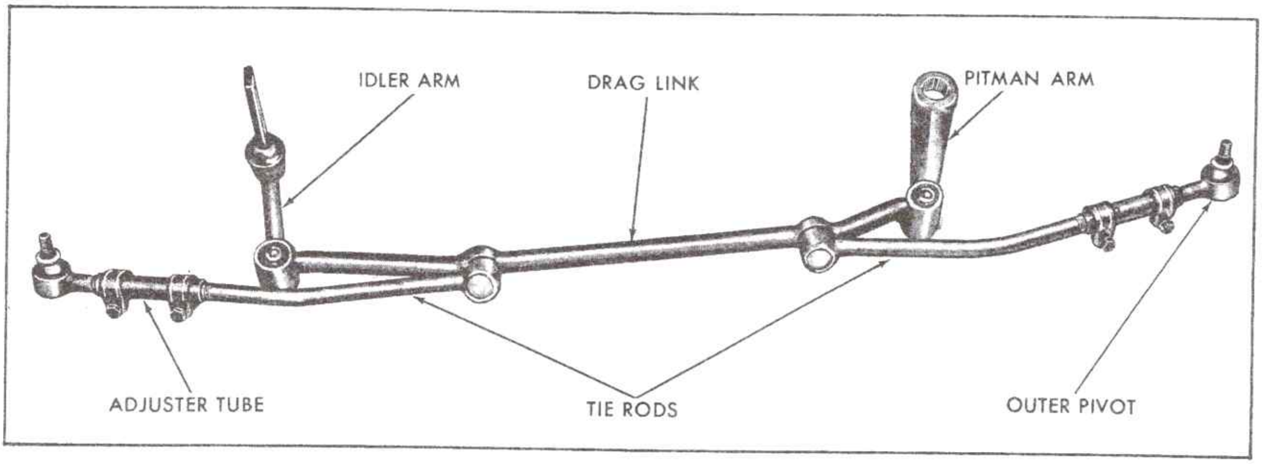


Fig. 9-2 Steering Linkage

The mechanical element of this steering gear is a low-friction, recirculating ball system, in which steel balls act as a rolling thread between the steering worm and the rack-piston. The one-piece rack-piston assembly is geared to the sector of the pitman shaft.

The hydraulic rotary valve is concentric with the input shaft and is contained in the upper section of the gear housing. It contains a spool that is held in neutral position by means of a torsion bar. The spool is attached to one end of the torsion bar and the valve body to the other end. Twisting of the torsion bar allows the spool to rotate in relation to the valve body, thereby operating the valve.

Under normal driving conditions the steering wheel effort will range from 1 to 1 1/2 pounds and parking effort will range from 2 to 2 1/2 pounds.

Steering Pump

The major components of the power steering pump are the oil reservoir, drive shaft, pump housing, cam ring, pressure plate, thrust plate,

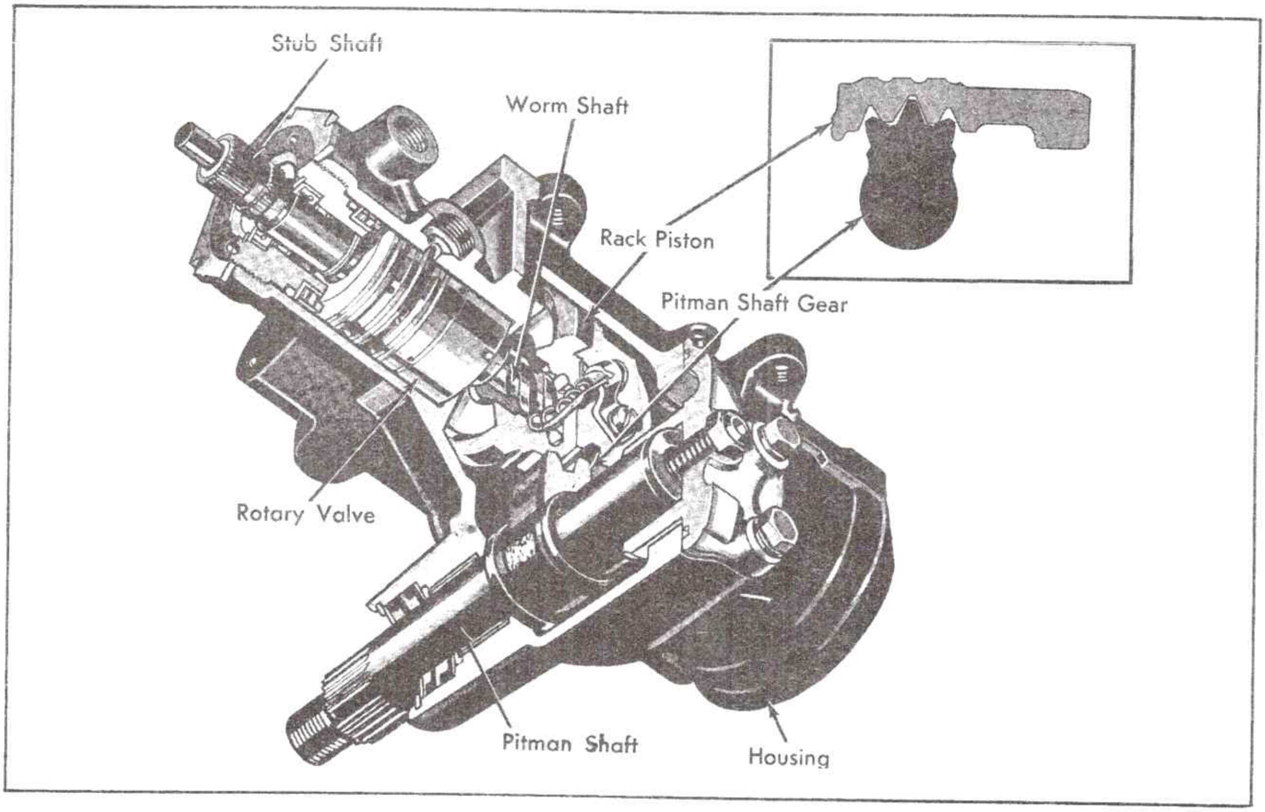


Fig. 9-3 Variable Ratio Steering Gear - Cut-Away View

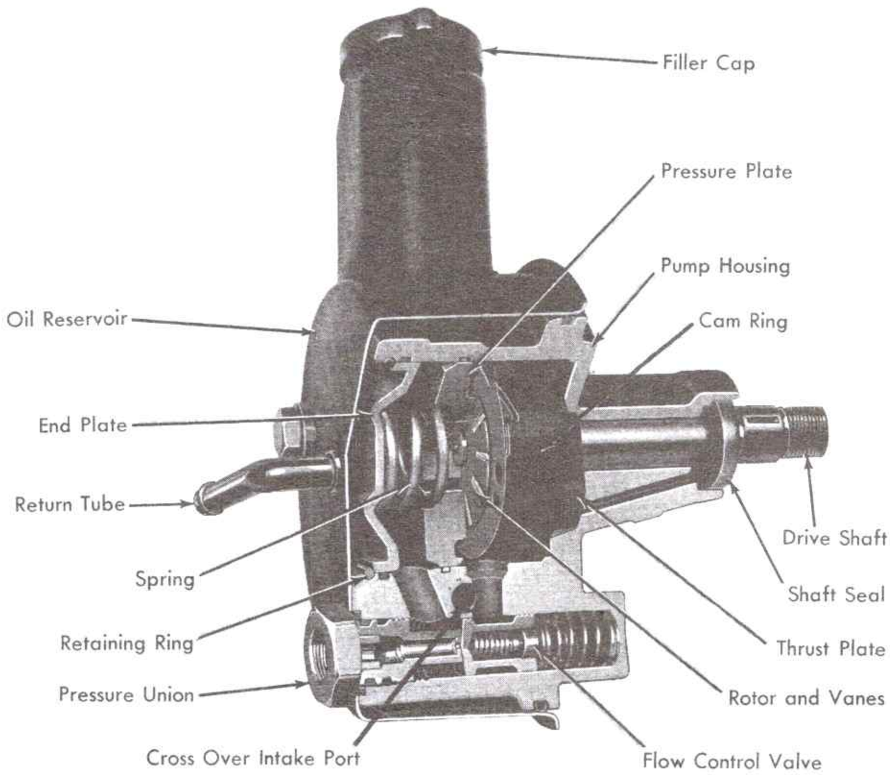


Fig. 9-4 Steering Pump Cut-Away View

flow control valve, and rotor and vane assembly, Fig. 9-4. The pump housing and component parts are encased in the oil reservoir, Fig. 9-4. The reservoir filler cap has a dipstick attached to show the oil level in the reservoir.

There are two bore openings at the rear of the pump housing. The larger of these openings contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve, and spring. The flow control orifice is part of the pressure line union. A pressure relief valve inside the flow control valve limits pump pressure to from 1350 to 1450 psi.

Energy Absorbing Steering Column (Fig. 9-5)

All steering columns used on Cadillac automobiles are of the energy absorbing type. The jacket is constructed with a portion that resembles a coarse screen, covered by a fabric sleeve. The steering shaft is constructed in two parts fitting together so that they can telescope. The shift tube is constructed in three telescoping parts. Plastic joints hold the telescoping parts so that they remain in the proper relationship under normal circumstances.

The column is held in the car by special mounts incorporating breakaway capsules that allow them to come loose in the event of excessive loads. If a load acts on the upper end of the column, the upper mount breakaway capsules will shear and allow the column to compress downward.

This column must be handled and serviced with extreme care so that the sections are not mispositioned. Observe the following precautions:

Use only the specified screws, bolts and nuts during reassembly. Avoid especially the use of over-length bolts as they might prevent a portion of the assembly from compressing under impact.

Equally important is the correct torquing of all nuts and bolts. Follow exactly the torque recommendations given in every step.

At no time should the column, shift tube, or steering shaft be struck from either end with a hammer, or pulled excessively. Care must be taken never to let the column drop when removing or installing.

Tilt and Telescope Steering Column (Figs. 9-6 and 9-48)

The Tilt and Telescope steering column consists of a steering shaft with a flexible joint, adjusting and locking mechanism for tilt adjustment;

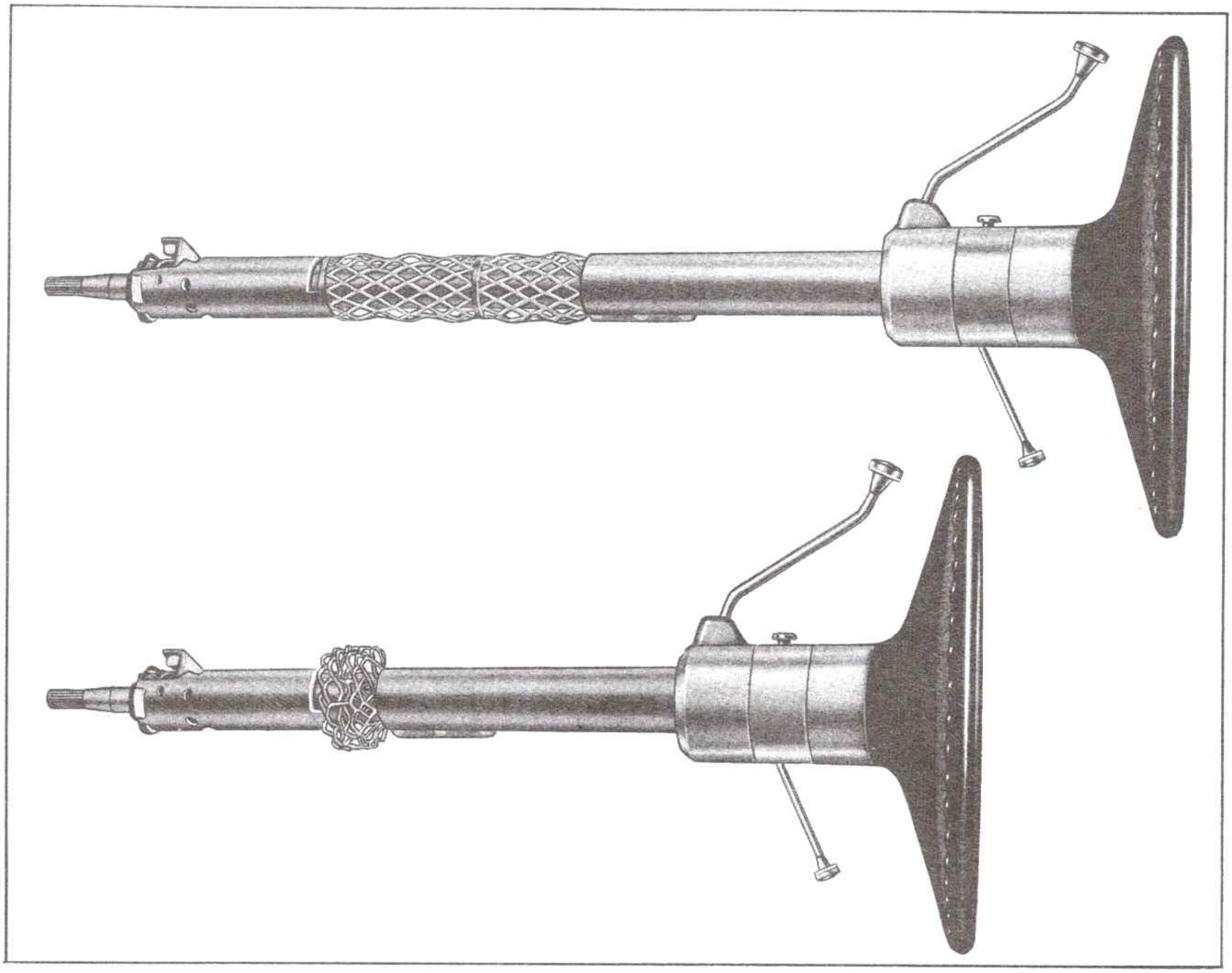


Fig. 9-5 Energy Absorbing Steering Column

a telescoping upper shaft and yoke assembly, and locking mechanism for telescopic adjustment. These adjustments are made independently of each other.

The up and down tilt action is achieved by pulling upward on a small lever located on the left side of the steering column just below the directional signal lever, moving steering wheel to one of six desired angles, then releasing lever to lock wheel in position. If no pressure is applied to the steering wheel when tilt lever is actuated, the steering wheel automatically raises to a higher position.

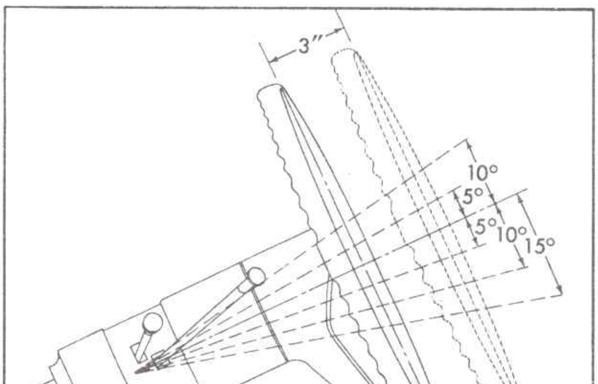


Fig. 9-6 Tilt and Telescope Steering Wheel

Two upward and three downward positions are possible in the tilt mechanism in addition to the normal driving position. These six positions cover a range of 25 degrees in 5 degree steps as shown in Fig. 9-6.

Two lock shoes regulate the degree of tilt. Grooves in the lock shoes engage pivot pins to lock the unit in position when the tilt lever is released.

The telescoping mechanism permits adjustment of the distance between the driver and the wheel to an infinite number of positions within a three inch range.

This adjustment is made by rotating the steering column locking lever counterclockwise to unlock the telescoping mechanism, positioning the

wheel for the desired distance, and locking the telescoping mechanism by turning the locking lever clockwise.

The three spoke steering wheel has a large cushioned area in the center. The driver activates the horn by pressing on the cushioned area of the steering wheel. The lead wires are connected to the horn upper contact assembly on the underside of the steering wheel. A coiled spring which expands and contracts when the wheel is telescoped connects the upper contact assembly with the lower.

The coiled spring rides upon a horn wire clip and spring assembly located in the turn signal housing. The horn wire is attached to the chassis wiring harness through a connector.

The horn, hazard warning and turn signal wiring are integral components of the turn signal housing assembly, and are serviced as an assembly.

The turn signal cancelling cams are located on the reverse side of the horn contact carrier assembly, and the turn signal, cornering light and hazard warning switches are located within the column. A jumper assembly for the turn signal lights, cornering lights and stop lights runs from the instrument panel harness to the switches.

The upper and lower ball bearings are serviced as part of the actuator housing. The bearing preload is set by the upper bearing spring.

Service operations on the steering gear, power steering pump, and steering linkage are exactly the same on cars equipped with a Tilt and Telescope wheel as on cars with the standard wheel. Steering gear adjustments are performed in the same manner and to the same specifications. Steering column to gear alignment and steering wheel alignment also are the same.

SERVICE INFORMATION

Four factors affect power operation of the steering system: fluid level and condition, drive belt tension, pump pressure and steering gear adjustment. These should always be checked before any major service operations are performed.

Conditions such as hard or loose steering, road shock, or vibrations are not always due to steering gear or pump, but are often related instead to such factors as low tire pressure, and front end alignment. These factors should be checked and corrected before any adjustment of the steering gear is made.

1. Checking Fluid Level

1. Run engine to normal operating temperature, then shut engine off. Remove reservoir filler cap and check oil level on dipstick. Level should be between "Full" mark and end of dipstick.

2. If oil level is below end of dipstick, add special power steering fluid to "Full" mark on dipstick and replace filler cap.

NOTE: When adding or making a complete fluid change, always use special power steering fluid available from servicing Parts Warehouses.

3. When checking fluid level after the steering system has been serviced, air must be bled from the system. Proceed as follows:

a. With wheels turned all the way to the left, add power steering fluid to "Add" mark on dipstick.

b. Start engine, and running at fast idle, recheck fluid level. Add fluid if necessary to "Add" mark on dipstick.

c. Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above internal pump casting. Fluid with air in it will have a light tan appearance. This air must be eliminated from fluid before normal steering action can be obtained.

d. Return wheels to center position and continue to run engine for two or three minutes, then shut engine off.

e. Road test car to make sure steering functions normally and is free from noise.

f. Recheck fluid level as described in steps 1 and 2, making sure fluid level is at "Full" mark on dipstick.

2. Checking Pump Pressure

1. Disconnect pressure hose at high pressure fitting on rear of pump. Have a container ready to catch dripping oil.

2. Connect gear end of an extra pressure hose to adapter, J-7786, on Gage Valve Assembly, J-5176-01, and other end to high pressure fitting on rear of pump, Fig. 9-7.

3. Install a 3/8 inch male pipe to 3/8 inch inverted flare union on valve side of gage and connect pressure hose to flare union.

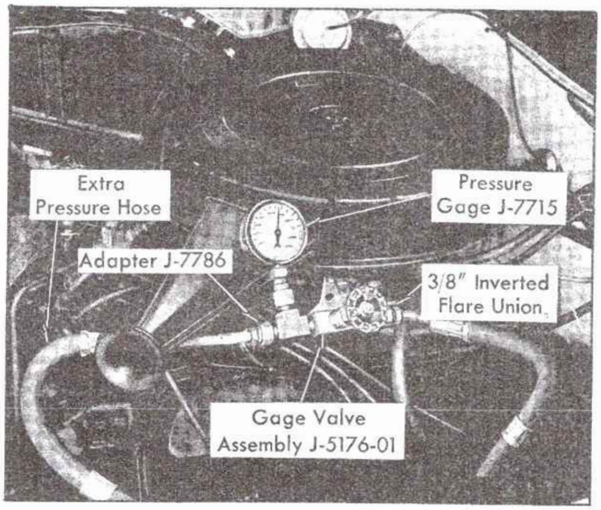


Fig. 9-7 Checking Pump Pressure

4. Open gage valve, start engine, run at idle, and recheck oil level.

5. With car weight on front wheels, turn steering wheel slowly against right or left stop. Hold wheel against either stop to obtain maximum pressure reading. Pressure gage should read not less than 1350 psi. If pressure will not reach 1350 psi, it indicates internal leaks in the gear or a defective pump.

CAUTION: Never hold wheels against stops for more than 5 seconds.

6. To determine which unit is at fault, check pump output separately by slowly closing gage valve. When pressure peaks on gage, note reading and quickly open gage valve. Pressure readings should be between 1350 and 1450 psi when valve is closed.

CAUTION: Do not leave gage valve closed for more than 5 seconds or damage to pump cam ring may result.

7. If the reading does not reach the specifications in step 6, pump needs servicing.

8. If pressure rises with valve closed, pump is functioning properly, and fault is in steering gear or lines.

9. Shut off engine, remove pressure testing equipment and reconnect pressure hose to pump.

10. Recheck oil level.

3. Steering Pump Belt Adjustment

a. Used Belt

NOTE: Any belt is considered used if it has been previously tensioned, even on a new car.

To install and adjust new belt or belts, see Note 3b.

1. Place Belt Tension Gage, J-7316, on pump belt mid-way between pulleys. On non-air conditioned cars select either belt to take reading.

2. Check gage reading. Reading should be at least 55 pounds on a used belt. On air conditioner equipped cars, proceed to step 4 to reset tension if gage reading is below 55 pounds.

3. On non-air conditioner equipped cars, place Belt Tension Gage, J-7316, on remaining pump belt mid-way between pulleys. Gage reading should be at least 55 pounds on a used belt. If either belt is below 55 pounds, place Belt Tension Gage, J-7316, on belt with lower reading and proceed to step 4 to readjust tension.

4. If belt tension is incorrect, loosen two bolts securing pump mounting bracket to engine.

5. Move pump outward by hand to attain proper tension by placing right hand on the filler neck and pulling pump toward fender. When adjusting a used belt on air conditioner equipped cars, tighten belt to a tension of 70 pounds. On non-air conditioner equipped cars, move pump until the belt with the lower reading attains 70 pounds. Do not use pry bar to move the pump as it will damage pump reservoir.

6. Tighten pump mounting screws to 35 foot-pounds.

NOTE: If it is found that a belt will not hold a minimum of 55 pounds, the belt should be replaced. On non-air conditioner equipped cars, always replace both belts if either will not hold a tension of 55 pounds. To install and adjust a new belt or belts, proceed as follows:

b. New Belt

NOTE: A new belt is one that has never been tensioned.

1. Loosen two bolts securing pump mounting bracket to engine.

2. Move pump outward by hand to attain proper belt tension by placing right hand on the filler neck and pulling pump toward fender. When adjusting a new belt on air conditioner equipped cars, tighten belt to a tension of 100 pounds. On non-air conditioner equipped cars, move pump until the belt with the higher tension reading attains 100 pounds.

NOTE: In no case should an attempt be made to offset belt stretch by overtensioning a new belt. Tensioning a belt over 100 pounds will result in excessive pump shaft bearing wear and shorten belt life. On non-air conditioner

equipped cars, two new belts must be installed if either is replaced.

4. Steering Pump Cooler

a. Removal (Fig. 9-8)

1. Loosen steering gear-to-cooler hose and steering pump-to-cooler hose hex slotted clamp screws at cooler. Disconnect hoses.

2. Tape ends of both hoses to prevent drainage of fluid and to keep dirt from entering system.

3. Remove two screws that secure cooler to fender dust shield and remove cooler.

b. Installation

1. Position steering pump cooler on fender dust shield, and secure with two screws.

2. Remove tape from ends of hoses, and connect steering pump-to-cooler hose to upper cooler tube and steering gear-to-cooler hose to lower cooler tube.

3. Tighten hex slotted clamp screws on hoses to 20 inch pounds.

5. Checking Steering Gear Adjustments (On Car)

Before making adjustments to the power steering gear to correct conditions such as shimmy, hard or loose steering, road shock, wander or weave; a check should be made of front end alignment, shock absorbers, wheel balance, or for tight front wheel bearings, loose steering rod ends or loose pitman arm.

When steering gear is thought to be out of adjustment, a quick check can be made by moving steering wheel back and forth with short slow motions at the "on center" position with engine off. Excessive looseness felt or heard indicates that either the pitman shaft or the thrust bearing requires adjustment. These adjustments can be made on car by following this procedure:

a. Thrust Bearing Preload Check (Just Away From the Stops)

1. Remove pitman arm from drag link using Puller Tool, J-8990, Fig. 9-9. Make certain tool is positioned with puller engaging tabs on pitman arm. On 693 disconnect pitman arm from drag link using Steering Linkage Puller, J-22292.

2. Check for any distortion or binding in flexible coupling. Correct as necessary, see Note 7.

3. Turn steering wheel just away from stops, and use a spring tension scale with a piece of tag wire or string to measure pull on steering wheel through an arc not exceeding one inch. Fig. 9-10. Total pull should be between 4 and 12 ounces (thrust bearing and friction).

4. If "off-center" pull is greater or less than specified, loosen adjuster plug locknut and back off adjuster plug 1/8 turn, using Spanner Wrench J-7624.

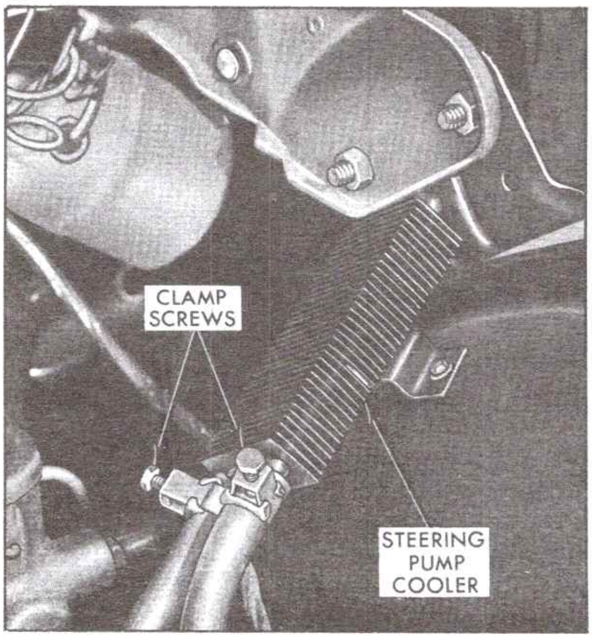


Fig. 9-8 Steering Pump Cooler (Except 693)

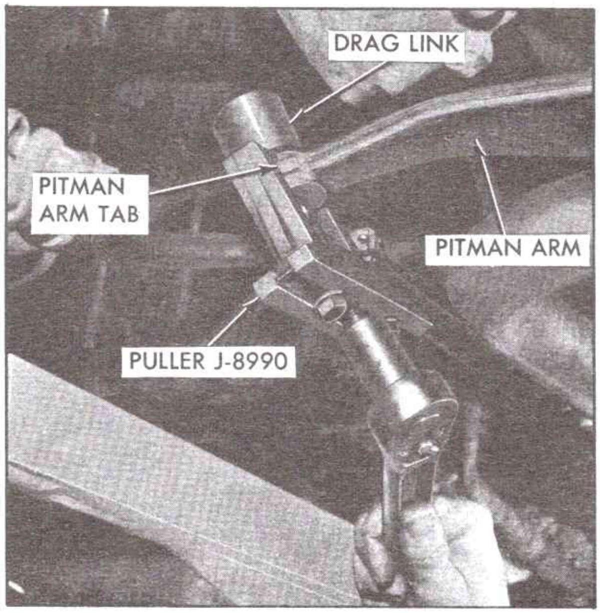


Fig. 9-9 Disconnecting Pitman Arm at Drag Link (Except 693)

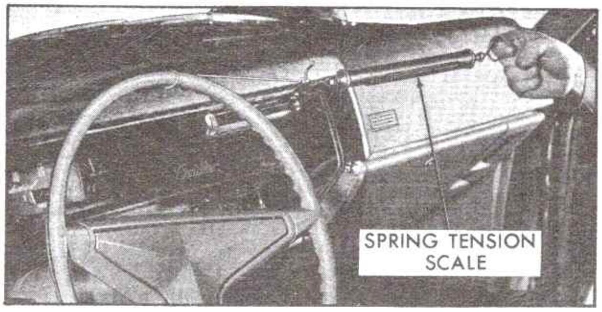


Fig. 9-10 Checking "Off-Center" Pull of Wheel

NOTE: If position of holes in adjuster plug is such that there is insufficient clearance for using Spanner Wrench, insert a #10 bolt 3/4 inch long in one of the adjuster plug holes and rotate flexible coupling until lower flange contacts bolt. Then back off adjuster plug 1/8 turn.

5. Recheck steering "pull" with wheel just away from the stops.

6. Adjust preload by tightening adjuster plug to obtain 2 to 6 ounces (at rim of steering wheel) in excess of total drag that was just measured with adjuster plug backed-off 1/8 turn.

7. Tighten adjuster plug locknut and recheck preload to insure that plug did not move when nut was tightened.

b. Checking Worm and Ball Preload (½ Turn Off-Center)

1. Locate center of steering wheel travel and turn wheel 1/2 turn "off-center"

2. With wheel 1/2 turn "off-center", measure and record total pull through an arc not exceeding one inch. Due to worm and ball preload, the total pull should be from 2 to 8 ounces in excess of the just away from the stop pull previously recorded.

3. If total pull is less than one ounce or more than 9 ounces in excess of just away from stop pull, steering gear must be removed from car and disassembled for replacement of worm shaft balls, see Note 13e.

4. Check for roughness in worm and rack-piston by turning wheel between 1/4 turn and 1 turn "off-center" on each side. Noticeable roughness also requires worm replacement.

c. Checking Pitman Shaft End Play (On-Center)

1. Find exact center of steering wheel travel. Tight spot due to pitman shaft should extend for 1/4 turn to either side.

2. With wheel "on-center", measure and record total pull through an arc of three inches or less.

3. This reading should not be more than 36 ounces, but should be at least 8 ounces (but never more than 20) more than a reading taken 1/2 turn "off-center".

NOTE: On new steering gears, the factory setting with ball bearing preloads and new seal drag may cause total pull to be as high as 40 ounces. Within the first 100 miles of operation, the seals seat themselves and the ball bearings polish the rack-piston and worm shaft grooves sufficiently to meet the service specifications.

4. If pitman shaft end play is not within limits, it should be adjusted so that "on-center" preload is 16-18 ounces more than the 1/2 turn "off-center" load but still not more than 36 ounces. Adjust on car by loosening locknut and turning adjusting screw as required. Recheck pull after tightening locknut.

5. When steering gear adjustments are completed, remove spring scale, connect pitman arm to drag link, and tighten drag link nut to 40 foot pounds. Install cotter key securing drag link nut.

6. Steering Linkage Parallelism

The parallelism of the steering linkage drag link should be checked in cases of steering wander and instability after the normal corrective adjustments such as standing height and front wheel alignment have been made. A quick check can be made by sighting from the front of the car with the car on a wheel alignment machine.

The drag link should appear parallel with the bottom of the engine oil pan, Fig. 9-11. If it is not, correction can be made by loosening the idler arm support bracket mounting screws on the frame side rail and adjusting the bracket to obtain

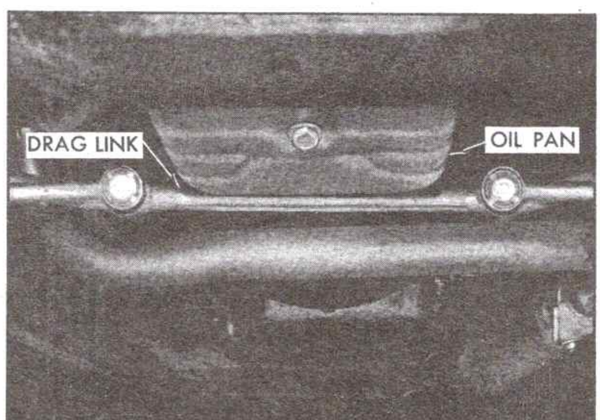


Fig. 9-11 Steering Linkage Parallelism

the desired drag link position. Tighten the mounting screws after adjustment.

If the correction required cannot be made by this adjustment, additional correction can sometimes be obtained by tightening the pitman arm nut to a higher torque. This will move the pitman arm further onto the steering gear splined shaft.

In no case should the pitman arm or idler arm be bent to obtain the required adjustment.

7. Steering Column to Gear Alignment

Whenever steering column or steering gear is removed or even loosened for service, alignment of these two units to each other should be checked. Proper alignment is essential to prevent side loading on the upper steering shaft lower bearing and stub shaft bearing of steering gear. Poor steering returnability, transmission of steering gear noises through steering column, and excessive wear of valve lands can result from misalignment of steering column with steering gear.

Alignment of steering column to gear should be gaged on position of flexible coupling. The steering column and gear are correctly aligned when flexible coupling is resting with rubber disc flat and safety pins centered in "C" slots of upper flange. The pins should also extend equally at both locations beyond edges of flange slots, Fig. 9-12.

If coupling rubber disc is distorted axially, loosen screw securing coupling to steering shaft and slide upper coupling flange up or down as required until coupling disc is flat.

Extreme caution must be used when aligning the column as it is very flexible. Damage to the neutral safety switch and high shift effort will occur if column is distorted.

When adjustment is required, proceed as follows:

1. Remove steering column lower cover as described in Section 12, Note 38a.

2. Slide rubber floor seal up on steering column.

3. Loosen steering column lower mounting screws and three support bolts at toe pan.

4. Carefully position steering column for proper alignment with instrument panel.

5. Rotate steering wheel slightly while aligning steering shaft to center flex coupling. When properly positioned within steering column upper cover, tighten all eight mounting bolts. First, the four horizontal bolts in the load capsule and then the four vertical screws.

6. With column in centered position, tighten the three support bolts at toe pan, and tighten flex coupling lower clamp screw.

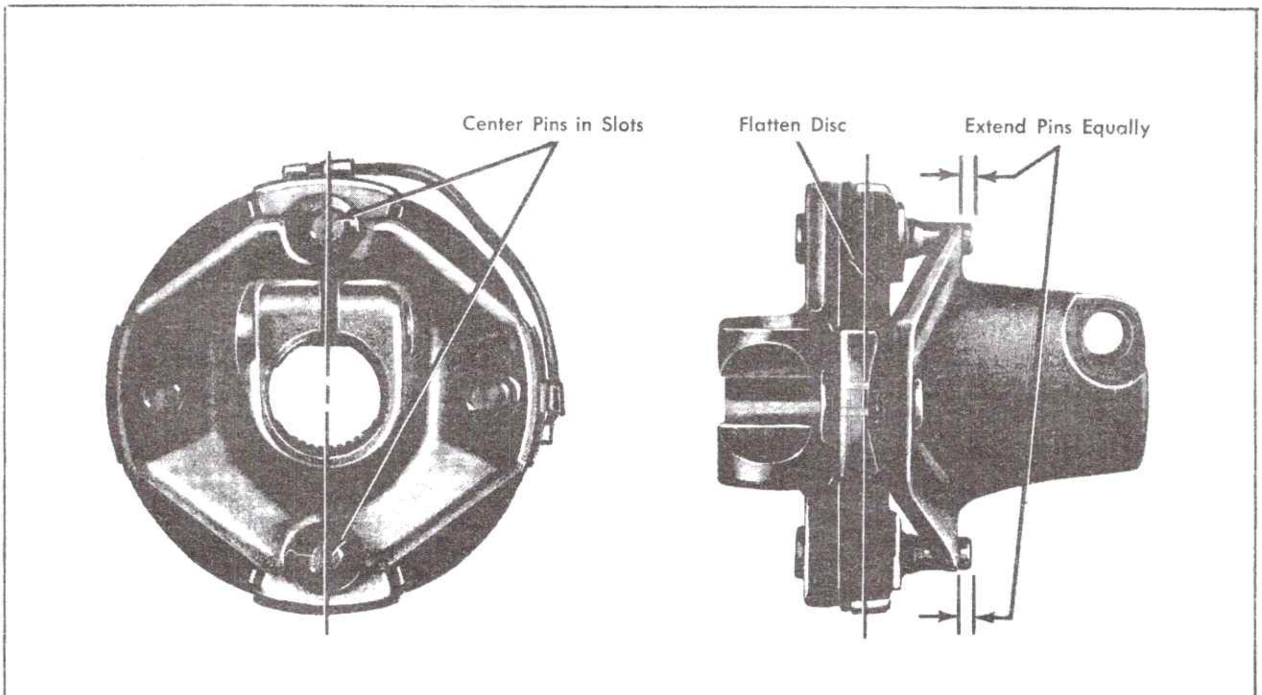


Fig. 9-12 Flexible Coupling - Steering Column to Gear Alignment

7. Install steering column lower cover as described in Section 12, Note 38b.

8. Replace carpet and slide steering column rubber cover in place. In severe cases of steering column misalignment, which may have resulted from collision, it may be necessary to remove lower support and enlarge holes in support to allow sufficient movement in the required direction.

CAUTION: In no case should an attempt be made to shim the gear at the frame.

8. Steering Pump

a. Removal

1. Disconnect pressure and return line hoses at rear of pump reservoir. Cap pump fittings to prevent drainage of fluid from pump. Also, cap or tape hose fittings.

2. Loosen two bolts that hold pump mounting bracket to engine, tilt pump toward engine centerline and remove drive belt or belts from pump pulley.

3. Remove bolts previously loosened and remove pump and bracket assembly from engine.

4. Remove pump filler cap and drain fluid from pump.

5. Clamp mounting bracket in vise with pump attached and remove pulley from shaft using Pump Pulley Puller, J-21883, Fig. 9-13.

CAUTION: Never remove pulley by pounding it off with hammer as this could damage pulley as well as snap ring at inner end of the shaft.

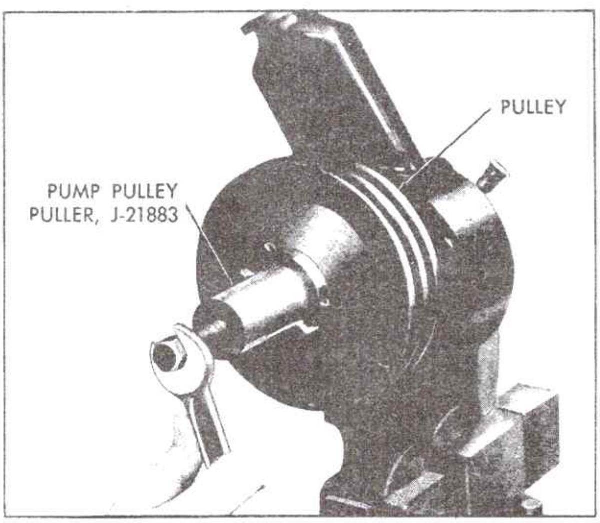


Fig. 9-13 Removing Pump Pulley

If the snap ring is damaged, complete disassembly of the pump is required for replacement.

6. Remove bracket by removing the two attaching bolts and lockwashers.

b. Installation

1. Install mounting bracket on pump and secure with two bolts and lockwashers. Tighten bolts to 23 foot-pounds.

2. Clamp mounting bracket in vise with pump attached.

3. Install pulley on shaft by first aligning key in shaft with keyway in pulley. Position pulley by hand as far on shaft as possible.

4. Install pulley nut, tightening to 45 foot-pounds.

5. Install pump and bracket assembly on engine and insert bolts, but do not tighten.

6. Connect pressure and return line hoses at rear of pump reservoir but do not tighten hose fittings.

7. Fill pump reservoir with steering pump fluid. Bleed pump by turning pulley backward (counterclockwise) as viewed from front until air bubbles cease to appear.

8. Install drive belt or belts on pump pulley.

9. Move pump outward until belt is tight. Adjust belt tension as described in Note 3.

10. Tighten hose fittings to 25 foot pounds.

NOTE: With pressure hose fitting finger tight, permit hose to assume a natural bend without twisting. Hold hose in this position and tighten fitting.

11. Fill pump reservoir to correct level with power steering fluid. See Note 1.

12. Bleed steering gear, as described in Note 1.

9. Steering Pump Disassembly, Cleaning and Inspection, and Assembly

a. Disassembly (Fig. 9-14)

1. Remove pump as described in Note 8a.

2. Place pump assembly in vise, hub down, using flat on hub for one clamping surface. Do

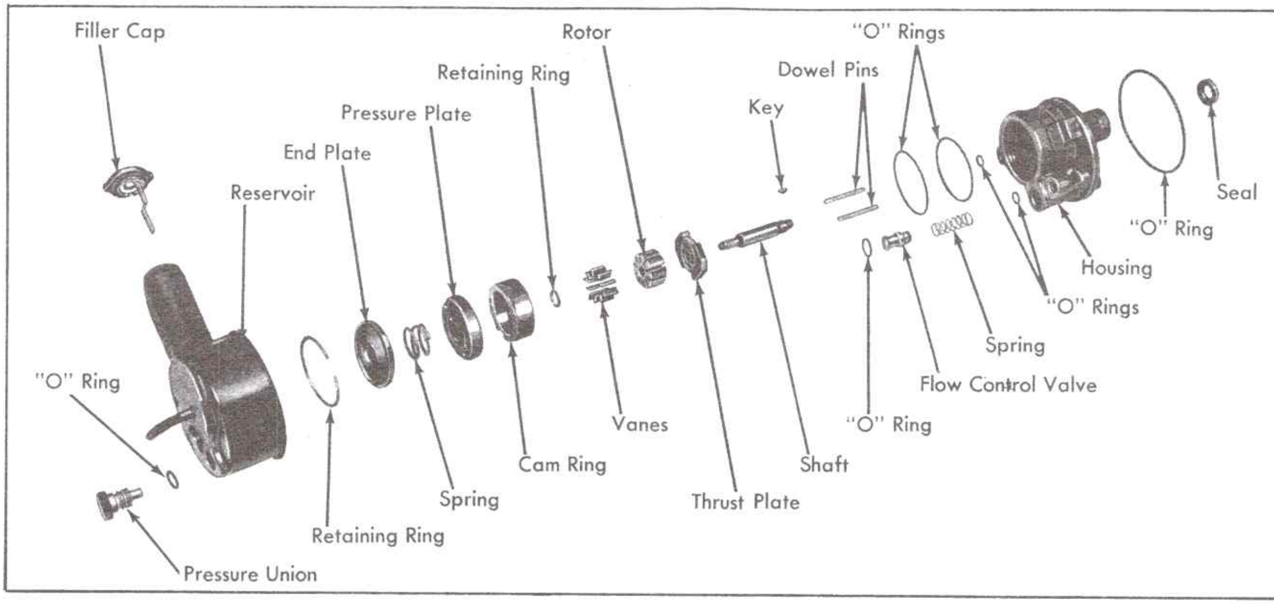


Fig. 9-14 Steering Pump Disassembled

not exert excessive force on hub as this may distort pump housing.

3. Remove pressure union and O-ring seal from rear of pump assembly. Discard O-ring seal.

CAUTION: Spring loaded flow control valve tends to ''pop'' out when pressure union is removed.

4. Lift reservoir from pump housing by rocking reservoir up and away from housing.

5. Remove and discard outer pump housing O-ring seal, mounting bolt O-ring seals, and flow control valve opening O-ring seal.

6. Rotate end plate retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-15.

7. Remove end plate. End plate is spring loaded and will generally raise above the housing, making removal easy. However, if end plate should stick, a slight rocking action on top surface will free the plate.

8. Remove pressure plate spring.

9. Remove woodruff key from shaft.

10. Remove pump from vise, and remove flow control valve and spring. Flow control valve is serviced as a unit and should not be disassembled.

11. Remove pressure plate, cam ring, and dowel pins from pump housing.

12. Tap end of shaft lightly on bench until shaft is free from pump housing. Then remove shaft with rotor and vanes, and thrust plate attached.

13. Remove vanes from rotor, then remove retaining ring from splined end of shaft and remove rotor and thrust plate from shaft.

NOTE: To remove retaining ring, clamp shaft in soft jawed vise, and using a pair of long nose pliers or a screwdriver, pry retaining ring off shaft. Be careful not to damage shaft with vise jaws.

14. Remove pressure plate O-ring seal and end plate O-ring seal from bore of housing and discard.

15. Remove shaft seal from housing only if defective, since it will be destroyed if it is removed. Remove shaft seal if necessary by prying out with screwdriver.

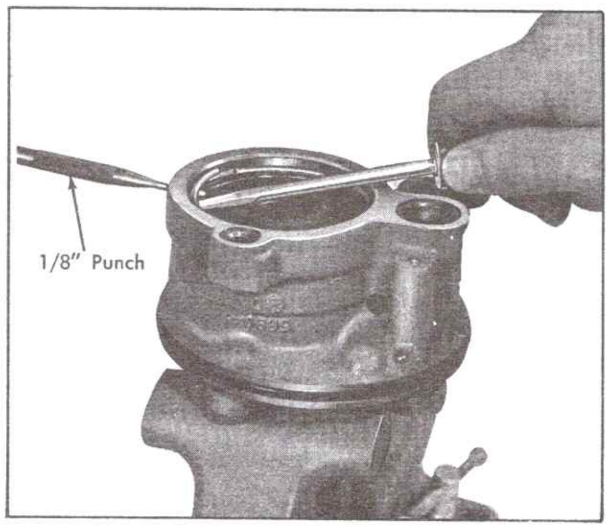


Fig. 9-15 Removing End Plate Retaining Ring

b. Cleaning and Inspection

Carefully clean all pump parts in cleaning solvent. Do not immerse the drive shaft seal in cleaning solvent as this could damage it. Replace any damaged or worn parts.

1. Inspect flow control valve assembly for score marks, wear, burrs, or other damage.

2. Inspect castings for cracks or other visual evidences of damage. Check machined surfaces, especially mating surfaces on O-ring seats, for scratches or burrs that might permit leaks. Examine the V-shaped notches at edges of discharge ports on pressure plate. These notches must be clean and undamaged if pump noise is to be avoided, as they cushion the hydraulic shock when each vane passes the port.

3. Inspect cam ring end surfaces for score marks.

NOTE: Cam ring is treated with "Lubrite" which leaves a dull gray-black finish on wear surface. Wavy grain appearance inside cam ring is normal.

4. Inspect pump shaft for score marks, excessive wear, or damage -- particularly at splines, keyway, and at bearing and seal surfaces. Separate and inspect rotor and vanes for wear and general condition.

5. Inspect shaft bushing in pump housing, and replace pump housing if bushing is scored or excessively worn.

6. If any internal parts are found to be worn or damaged, flush steering gear or disassemble gear and clean internal parts.

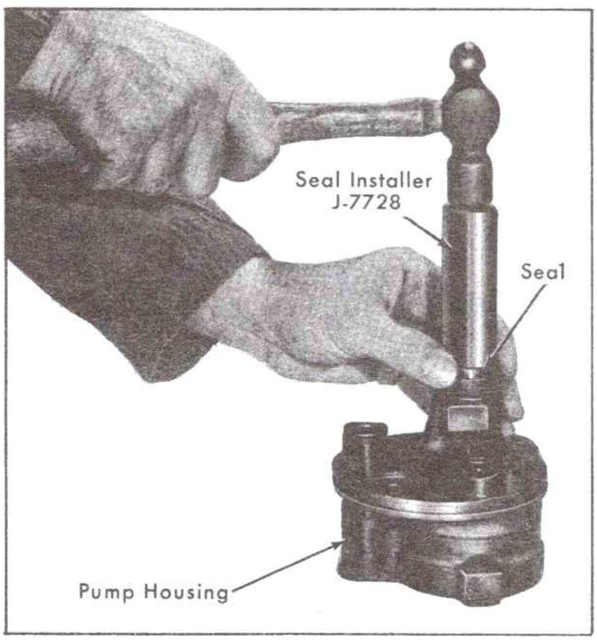


Fig. 9-16 Installing Pump Shaft Seal

c. Assembly

1. Lubricate new O-ring seals and seal areas with power steering fluid.

2. If drive shaft seal was previously removed, lubricate new shaft seal with power steering fluid and install in housing with metal backing up. Use Seal Installer, J-7728, Fig. 9-16.

3. Install new pressure plate and end plate O-ring seals in grooves in pump housing.

4. Install thrust plate on drive shaft with ported face toward splined end of shaft.

5. Install rotor on shaft with counterbored end toward thrust plate.

6. Clamp shaft in soft jawed vise and install new retaining ring on splined end of shaft by prying ring open and sliding it down over shaft until it seats itself in ring groove. Be careful not to damage shaft.

7. Insert drive shaft with thrust plate and rotor into housing, using Seal Protector, J-22616, Fig. 9-17. Make sure that shaft is properly seated.

8. Place pump housing in vise, hub down, using flat on hub for one clamping surface.

9. Install dowel pins through thrust plate into pump housing.

10. Install cam ring on dowel pins with rotation arrow toward rear of pump housing and pointing in direction of pump rotation, Fig. 9-18. Direction of rotation is counterclockwise when viewed from rear of pump.

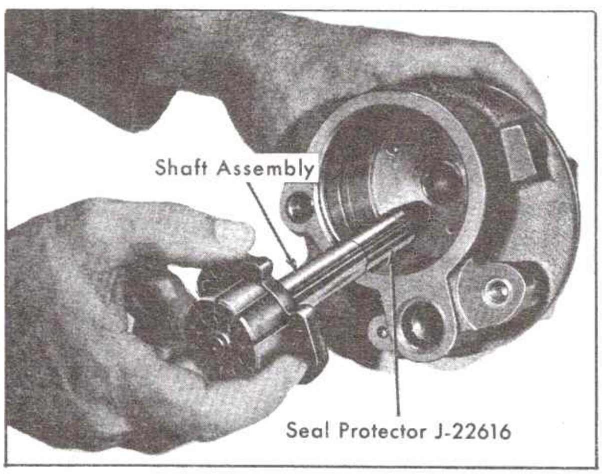


Fig. 9-17 Installing Pump Shaft Assembly

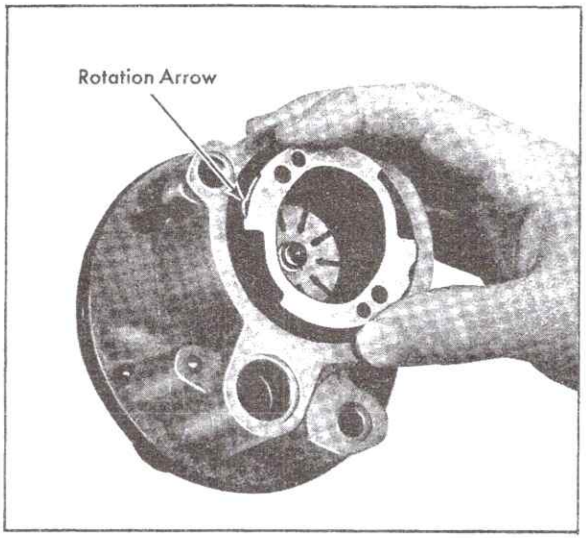


Fig. 9-18 Installing Cam Ring

11. Install vanes in slots in rotor, with radius edges toward outside of rotor, so they ride on cam ring.

12. Lubricate outside diameter of pressure plate with petrolatum to prevent damage to O-ring and install pressure plate on dowel pins with ported face toward cam ring. Install plate so that narrow slots in plate engage dowel pins. Make sure that pressure plate is properly seated by tapping lightly around outer circumference with a wooden hammer handle.

13. Install pressure plate spring.

14. Lubricate outside diameter of end plate with petrolatum and install end plate in pump housing.

15. Place pump housing in arbor press, depress end plate below retaining ring groove, and install end plate retaining ring, Fig. 9-19. Make certain that ring is completely seated in groove of housing.

16. Install new outer pump housing O-ring seal, flow control valve opening O-ring seal and mounting bolt O-ring seals in pump housing.

17. Install reservoir on pump housing. Do not hammer on housing.

18. Install flow control valve spring.

19. Install flow control valve; hex head screw goes into bore first, Fig. 9-20.

20. Install pressure union using a new O-ring seal. Tighten to 30 foot-pounds.

21. Install mounting bracket on pump and secure with two bolts and lockwashers. Tighten bolts to 23 foot-pounds.

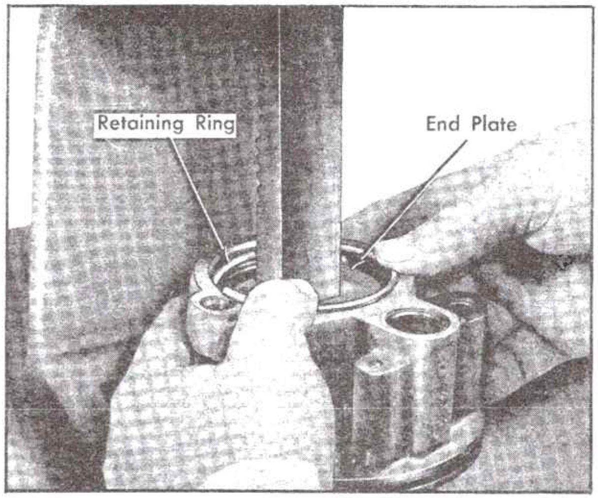


Fig. 9-19 Installing End Plate Retaining Ring

22. Remove pump assembly from vise. Support drive shaft on edge of bench and install woodruff key.

10. Steering Pump Shaft Seal Replacement (Off Car)

Steering pump shaft seal cannot be replaced with pump on car as there is insufficient clearance for application of tools for removing pulley and installing seal. For replacing seal only, proceed as follows:

1. Remove pump from car as described in Note 8a, steps 1 through 3.

2. Clamp mounting bracket in vise with pump attached and remove pulley from shaft, using Pulley Remover, J-21883, Fig. 9-13.

CAUTION: Never remove pulley by pounding it off with a hammer as this could damage pulley as well as internal parts.

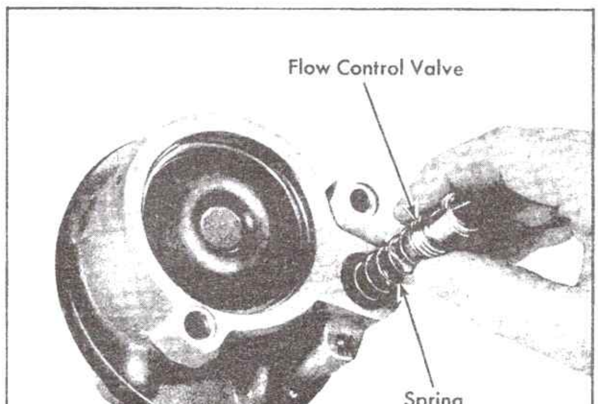


Fig. 9-20 Installing Flow Control Valve

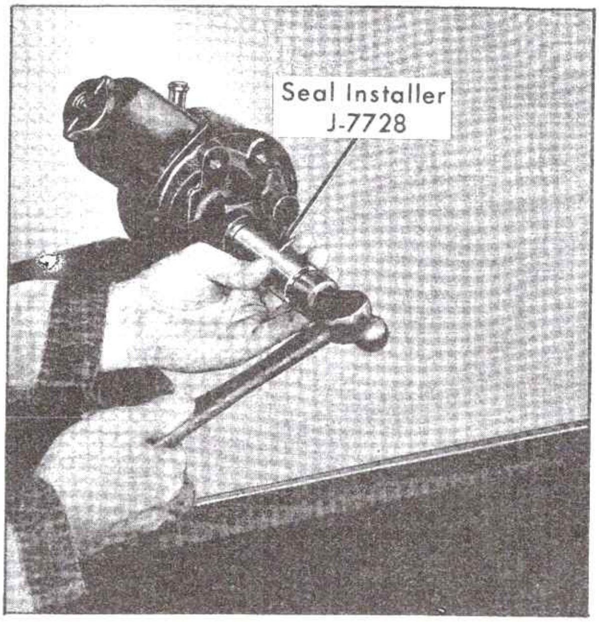


Fig. 9-21 Installing Pump Shaft Seal
(Without Disassembling Pump)

3. Remove woodruff key from pump drive shaft.

4. Remove shaft seal by prying out with sharp tool.

CAUTION: Insert sharp tool between seal and pump housing. Do not pry against pump shaft.

5. Install Seal Protector, J-22616, on pump drive shaft.

6. Position new shaft seal on drive shaft with metal backing facing pulley end of shaft.

7. Install seal, using Pump Shaft Seal Installer, J-7728, Fig. 9-21. Tap tool lightly with small hammer until seal is properly seated in shaft hub.

8. install woodruff key on pump drive shaft.

9. Install pump on car as described in Note 8b.

11. Steering Gear Assembly

a. Removal

1. Disconnect pressure and return line hoses at rear of pump reservoir. Cap pump fittings to prevent drainage of fluid from pump. Also, cap or tape hose fittings. On cars equipped with a steering pump cooler, disconnect return hose at cooler.

2. Raise front end of car and place jack stands near outer ends of lower suspension arms.

3. Remove cotter pin and nut at pitman arm.

4. Disconnect pitman arm from steering linkage drag link, using puller tool, J-8990.

NOTE: Make certain puller tool engages the tabs on the pitman arm.

5. Remove screw that holds flexible coupling to steering gear shaft.

6. Remove three screws that hold steering gear to frame side rail, lower gear assembly down and out of car with pitman arm attached.

7. Working on bench, break pitman arm loose from pitman shaft, using Pitman Arm Puller, J-9172; and remove pitman arm from steering gear.

b. Installation

1. Place steering gear in position on frame side rail, so that flexible coupling half on gear matches half on steering shaft, and install three gear housing to frame mounting screws. Tighten screws to 60 foot-pounds.

2. Install screw that holds flexible coupling to steering gear shaft. Tighten to 30 foot-pounds.

3. Check gear to steering column alignment and adjust as described in Note 7.

4. Position pitman arm on pitman shaft and drag link and install lockwasher and nut on end of pitman shaft. Tighten nut to 140 foot-pounds.

5. Install steering linkage drag link to pitman arm. Tighten nut to 35 foot-pounds and install cotter pin.

6. Connect pressure and return line hoses to pump. Tighten fittings to 25 foot-pounds.

7. Check fluid level and bleed hydraulic system as described in Note 1.

12. Steering Gear, Removal of Major Components

1. Position gear assembly in vise with gear housing end plug facing up.

2. Rotate gear housing end plug retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screw-driver to be inserted to lift ring out, Fig. 9-22.

3. Rotate coupling flange counterclockwise until rack-piston just forces end plug out of housing. Remove end plug and O-ring from housing.

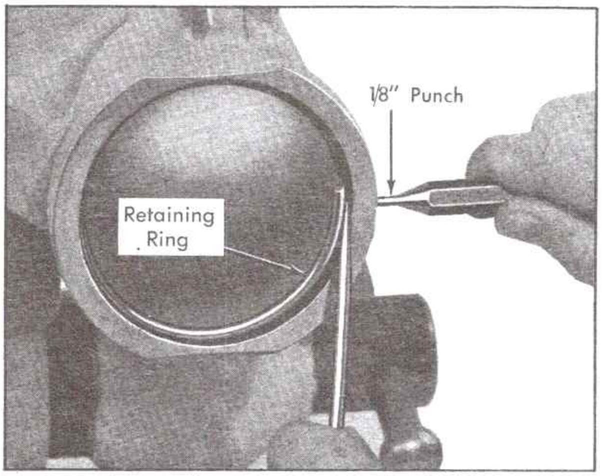


Fig. 9-22 Removing End Plug Retaining Ring

CAUTION: Do not rotate any further than necessary or balls will fall out of their circuit and pitman shaft teeth and rack-piston will become disengaged.

4. Turn coupling flange until pitman shaft teeth are centered in housing.

5. Remove rack-piston end plug using a 1/2 inch square drive.

NOTE: To make removal easier, tap rack-piston end plug with a plastic mallet to unseat threads. This is important, as end plug is tightened to 75 foot-pounds during assembly and could break during removal if not handled carefully.

6. Remove locknut from adjuster screw on end of pitman shaft and discard.

7. Remove four side cover-to-housing retaining screws and lockwashers from cover.

8. Rotate pitman shaft adjuster screw with an Allen wrench until side cover is lifted free from housing.

9. Separate side cover from pitman shaft. Discard side cover O-ring seal.

10. Tap end of pitman shaft with a soft mallet and slide pitman shaft out of housing.

11. Remove housing end plug O-ring seal from housing and discard if not previously removed.

12. Insert Rack-Piston Arbor, J-7539, into rack-piston against end of worm. Turn coupling flange counterclockwise, while holding tool tightly against worm, to force rack-piston on to arbor, and remove rack-piston from gear housing, Fig. 9-23.

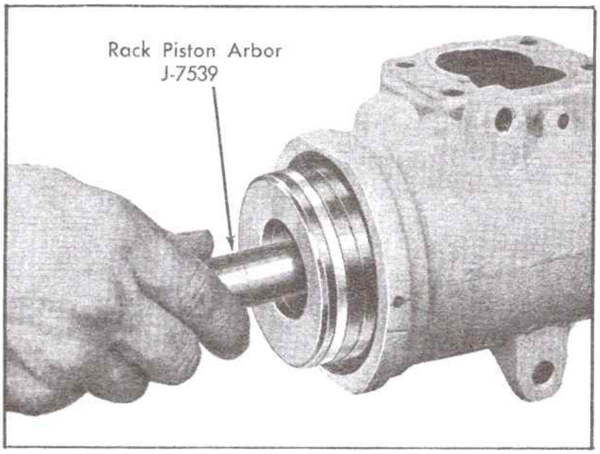


Fig. 9-23 Installing Rack-Piston Arbor Tool in End of Worm

NOTE: On 693 steering gears the large snap ring visible at the bottom of the bore is a stop. Do not remove this snap ring.

13. Remove flexible coupling flange retaining screw and remove coupling flange assembly.

14. Remove adjuster plug locknut by breaking it loose with hammer and punch, and remove locknut from housing.

15. Loosen adjuster plug assembly, using Spanner Wrench J-7624, Fig. 9-24, and remove from housing.

16. Remove valve assembly by grasping stub shaft and pulling out.

17. Remove worm, lower thrust bearing, and races from upper end of housing.

13. Steering Gear, Disassembly, Inspection, and Assembly of Major Components

Disassembly of the major components within the gear must be performed on a clean workbench.

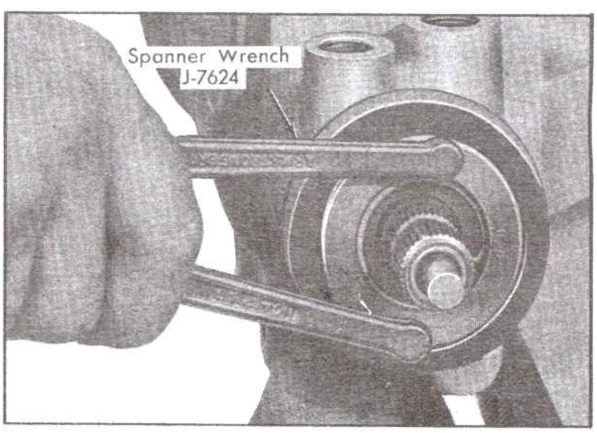


Fig. 9-24 Removing Adjuster Plug Assembly

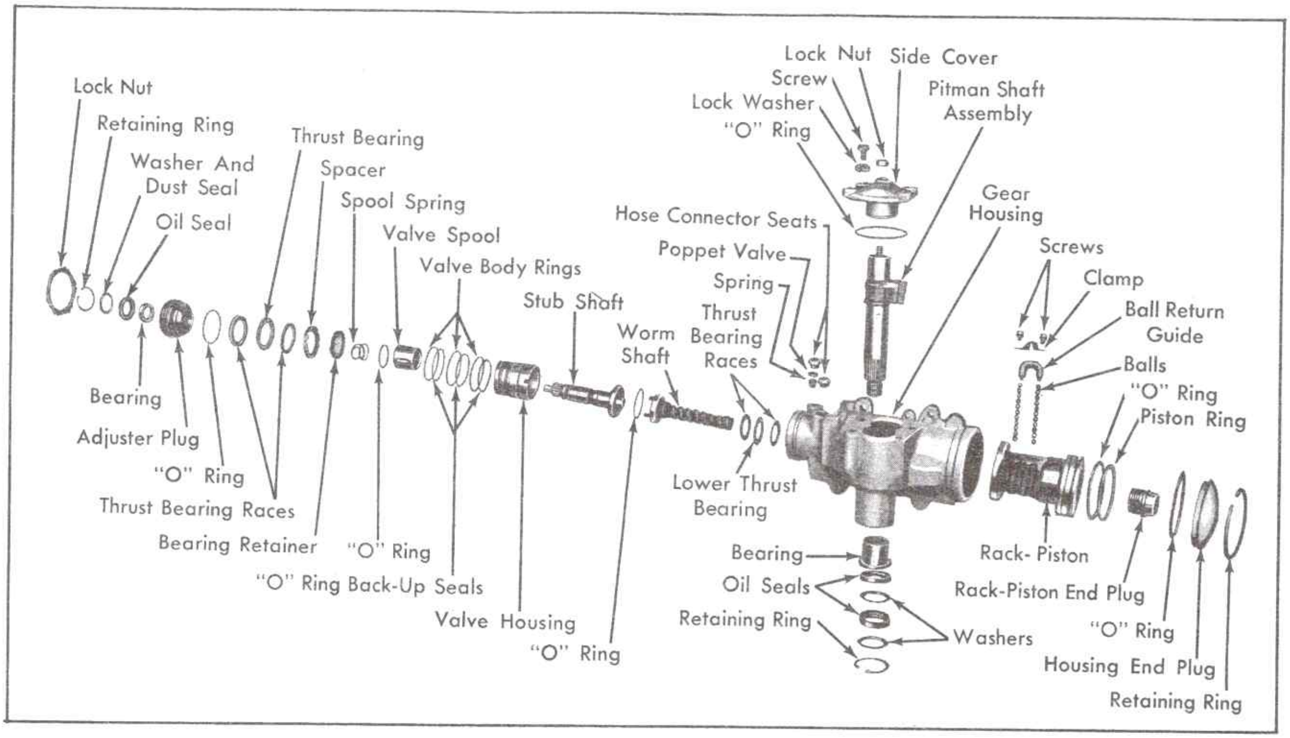


Fig. 9-25 Steering Gear Disassembled

The work area, tools, and parts must be kept clean at all times. Refer to Fig. 9-25, for parts nomenclature and location.

a. Gear Housing, Pitman Shaft Needle Bearing, and Seals

Disassembly

1. Remove pitman shaft seal retaining ring from gear housing, using Snap Ring Pliers, J-4245 (#3), and then remove outer back-up washer.

2. Insert a screwdriver between outer seal and inner back-up washer, pry out seal, and remove back-up washer.

3. Insert screwdriver between inner seal and shoulder in gear housing and pry out seal. Be careful not to damage seal bore. Discard seals.

4. Inspect pitman shaft and needle bearing. If rollers are broken or pitted, drive needle bearing from gear housing bore with Pitman Shaft Bearing Remover, J-6657.

Inspection

1. Inspect housing bore. If badly scored or worn, replace housing.

2. Inspect high pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 15. Inspect poppet and seat and replace if deformed or scored.

3. Inspect low pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 15.

4. Inspect ball plug in valve body end of housing. If it is leaking or raised above the surface, it may be driven in flush or 1/16 inch below surface. Ball can be tightened by staking housing.

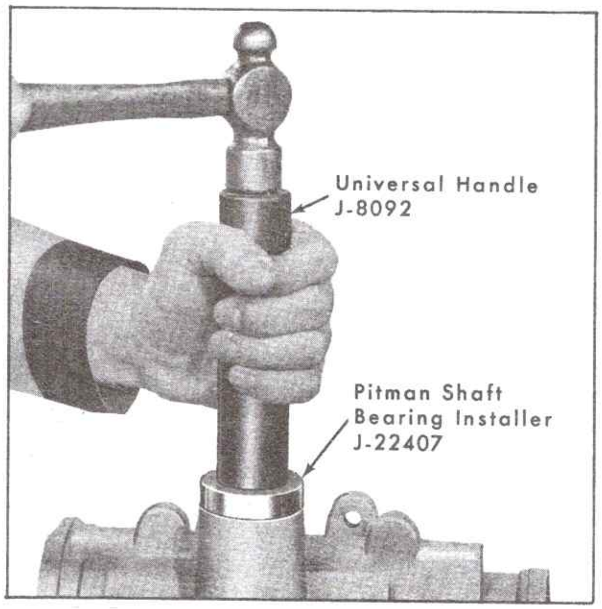


Fig. 9-26 Installing Pitman Shaft Bearing

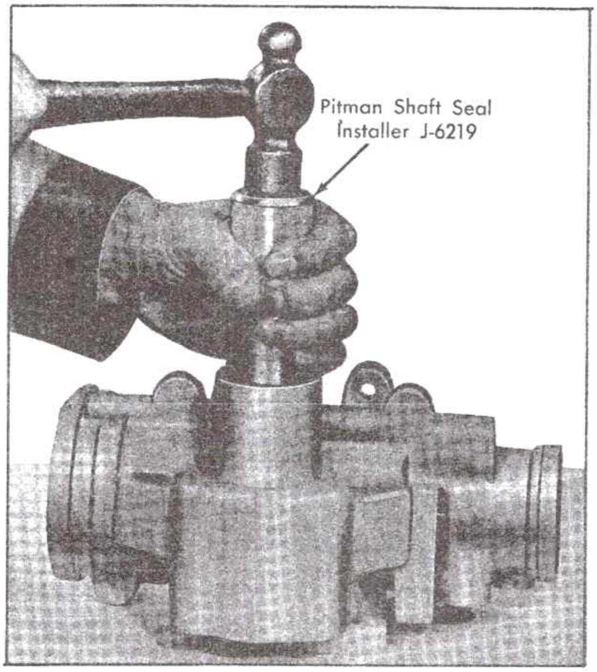


Fig. 9-27 Installing Pitman Shaft Seal

5. Inspect all retaining ring grooves and seal surfaces for damage or failure.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. If pitman shaft needle bearing was previously removed, install new bearing on Bearing Installer J-22407, with letters on bearing against tool. Position bearing and tool in housing and press bearing into housing, until bearing is bottomed out against hub of housing, Fig. 9-26. On constant ratio steering gears press bearing in until bottom edge of bearing is flush with the housing bore surface.

3. Lubricate pitman shaft bore and single lip pitman shaft seal with power steering fluid and install seal, lip down, into bore, using Seal Installer, J-6219, Fig. 9-27. Do not drive seal more than 1/8 inch below lip of bore.

4. Remove tool and place steel washer on top of seal. Using tool J-6219, drive seal approximately 1/2 inch further into bore.

5. Lubricate double lip seal with power steering fluid and install seal into housing bore. Using Seal Installer, J-6219, drive seal down into bore until top edge of seal is flush with bottom edge of snap ring groove.

6. Remove tool and place steel washer and snap ring over seal. Using tool J-6219, drive both seals down into bore until snap ring falls into snap ring groove.

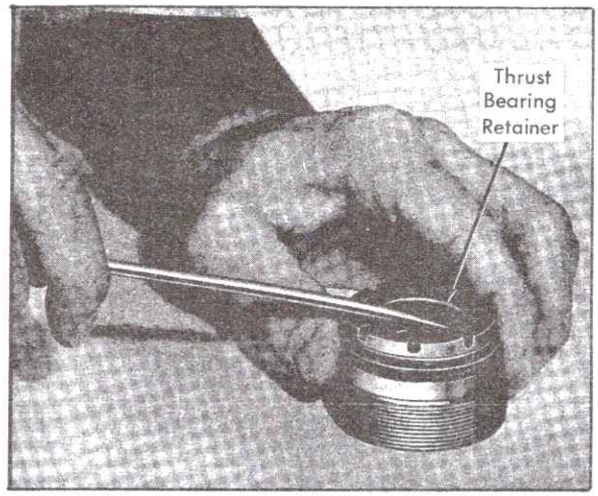


Fig. 9-28 Removing Thrust Bearing Retainer

NOTE: In order to avoid possible damage to sealing surface of lower seal, it is important that seals and washers be driven down only far enough so that snap ring falls into ring groove.

b. Adjuster Plug Assembly

Disassembly

1. Remove thrust bearing retainer with a screwdriver, Fig. 9-28, being careful not to score needle bearing bore, and discard. Remove thrust bearing spacer, thrust bearing, and thrust bearing races.

2. Remove adjuster plug O-ring seal and discard.

3. Remove stub shaft retaining ring, using Snap Ring Pliers, J-4245 (#3).

4. Remove combination washer and dust seal and discard.

5. Remove stub shaft oil seal by prying out with screwdriver and discard.

Inspection

1. Inspect needle bearing in adjuster plug. If rollers are broken or pitted, remove needle bearing by pressing out from thrust bearing end, using Adjuster Plug Bearing Remover and Installer, J-6221, Fig. 9-29.

2. Inspect thrust bearing spacer for cracks.

3. Inspect thrust bearing rollers for wear, pitting, scoring, or cracking. If any of these conditions are found, replace bearing and both thrust bearing races and check thrust bearing spacer.

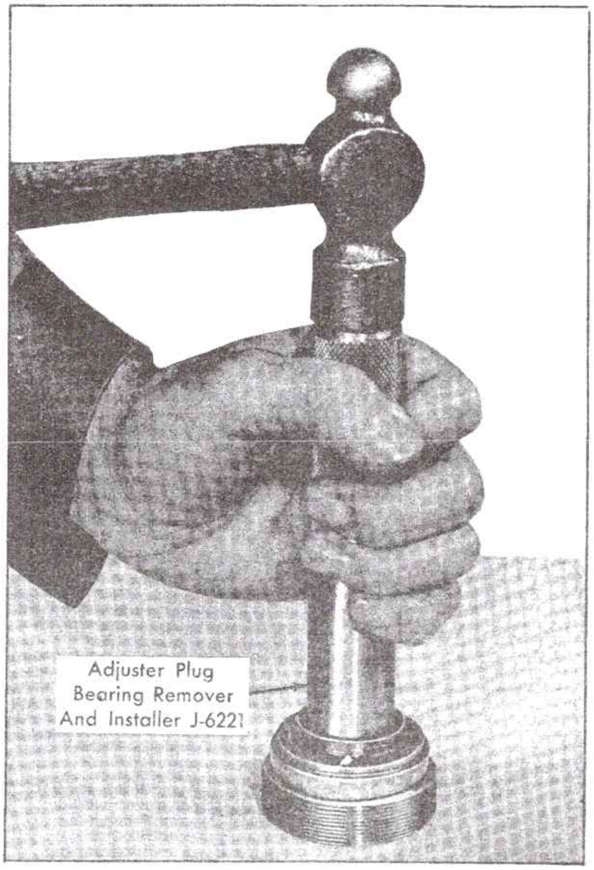


Fig. 9-29 Removing and Installing Adjuster Plug Needle Bearing

4. Inspect thrust bearing races for wear, pitting, scoring, cracking or brinelling. If any of these conditions are found, replace races and check thrust bearing and thrust bearing spacer.

Assembly

1. If adjuster plug needle bearing was previously removed, install new needle bearing on Tool J-6221, with letters on bearing against tool. Position bearing and tool over thrust bearing end of plug and drive bearing into plug, Fig. 9-29. End of bearing must be flush with bottom surface of stub shaft seal bore.

2. Lubricate new stub shaft oil seal with power steering fluid and, using Adapter Plug Seal Installer, J-5188, Fig. 9-30, install seal far enough to provide clearance for dust seal and retaining ring.

3. Lubricate new dust seal with power steering fluid and install in plug with rubber face outward.

4. Install retaining ring with Snap Ring Pliers, J-4245 (#3), making certain that ring is properly seated.

5. Lubricate new O-ring seal with power steering fluid and install in groove on adjuster plug.

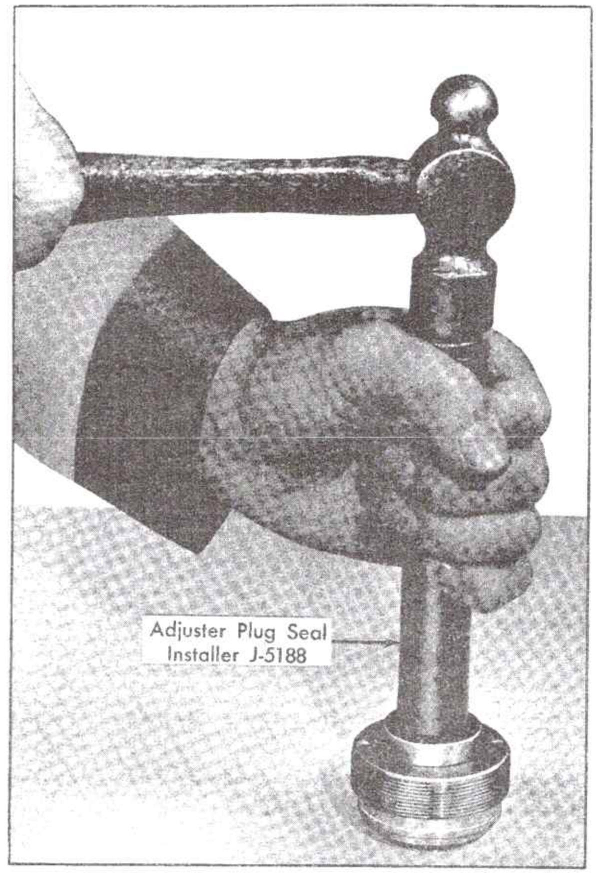


Fig. 9-30 Installing Oil Seal

Assemble large O.D. thrust bearing race, and thrust bearing, small thrust bearing race, and thrust bearing spacer on adjuster plug. Press bearing retainer into needle bearing bore, using a brass or wooden dowel. Radial location of dimples is not important.

c. Stub Shaft and Valve Assembly

The complete valve assembly is a precision unit with selective fitted parts hydraulically balanced during assembly. If replacement of any valve part other than rings or seals is necessary, the complete rotary valve assembly must be replaced.

Do not disassemble valve unless absolutely necessary, to avoid possibility of damage to the assembly. If valve spool dampener O-ring requires replacement, remove valve spool as outlined below, replace O-ring and install spool.

Disassembly

1. Remove cap to worm O-ring seal and discard.

2. Remove spool spring by prying small coil, using a small screwdriver. Work spring onto

bearing diameter of stub shaft. Slide spring off stub shaft.

3. Remove valve spool from valve body.

CAUTION: Clearance between valve body and spool may be as low as .0004 inch. Slightest cocking of spool may cause it to stick in the valve body. To remove valve spool:

a. Hold valve assembly in both hands with stub shaft pointed downward.

b. Place fingers under valve body and thumbs on valve body cap, holding it securely against valve body.

c. Tap end of torsion bar lightly against workbench. This will expose spool far enough so that it may be withdrawn from valve body:

d. Withdraw spool with a steady twisting pull to prevent jamming. If slight sticking occurs, carefully work spool back into valve body. If this does not free spool, it has become cocked in the valve body bore. Do not attempt to force the spool in or out if it becomes cocked. Continue to disassemble valve assembly as follows and return to spool as described later.

4. Remove stub shaft, torsion bar, and valve cap assembly by holding valve assembly in both hands as before, only with thumbs on valve body. Tap torsion bar lightly against workbench. This will dislodge cap from valve body-to-cap pin. Stub shaft, torsion bar, and valve cap assembly can now be removed from valve body.

5. If valve spool has become cocked as described in step 3, it can now be freed. Visual inspection on a flat surface will show in which direction spool is cocked. A few very light taps with a light, soft plastic or rawhide mallet should align spool in bore and free it.

CAUTION: Do not tap with anything metallic. If spool can be rotated, it can be removed.

Inspection

1. If there is evidence that torsion bar O-ring seal inside stub shaft has been leaking, entire valve assembly should be replaced.

2. Check pin in valve body that engages cap. If it is severely worn, cracked, or broken, the entire valve assembly should be replaced.

3. Check smaller of the two worm pin grooves in valve body. If it is severely worn, entire valve assembly should be replaced.

4. Check spool drive pin on stub shaft. If it is severely worn, cracked, or broken, entire valve assembly should be replaced.

5. Examine spool O.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.

6. Examine valve body I.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.

7. Check fit of spool in valve body before installing valve spool dampener O-ring seal.

When lubricated with power steering fluid, spool should rotate smoothly without binding or catching. If either occurs, entire valve assembly should be replaced.

8. Measure spool spring with a scale. Free length should be 53/64 inch. Inner diameter of top loop of spring should be 49/64 inch to 51/64 inch. Replace spring if measurements are not as specified.

9. Examine needle bearing diameter of stub shaft. If it is badly worn, or scored, entire valve assembly should be replaced.

10. Visually inspect valve body rings. If damaged, carefully cut valve rings and O-ring back-up seals. Remove and discard.

Assembly

1. If new valve body ring back-up O-ring seals are necessary, lubricate them with power steering fluid. Assemble in ring grooves on valve body. Do not allow seals to become twisted. If new valve rings are necessary, lubricate them with power steering fluid and assemble valve rings in ring grooves over back-up O-ring seals by carefully slipping rings over valve body, Fig. 9-31. Rings may appear to be loose in grooves, but the heat of the oil after assembly will cause them to tighten.

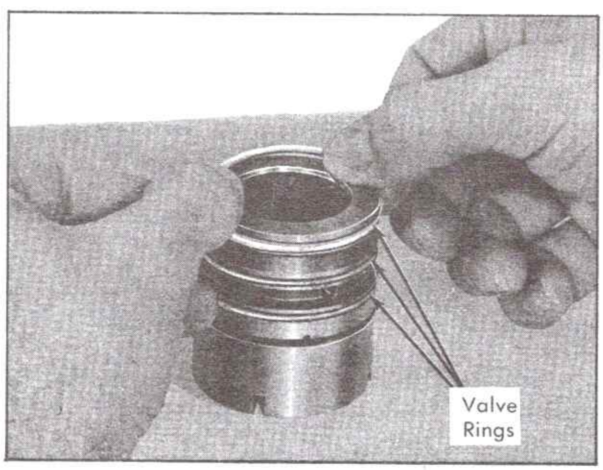


Fig. 9-31 Installing Valve Ring

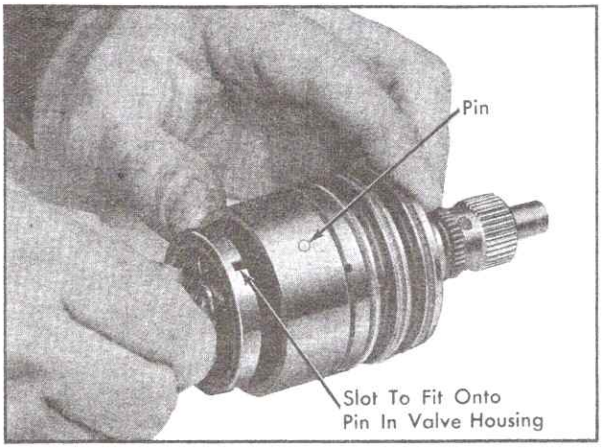


Fig. 9-32 Installing Stub Shaft in Valve Body

2. Lubricate new valve spool dampener O-ring seal with power steering fluid and install seal in valve spool groove.

3. Assemble stub shaft in valve body, aligning groove in valve cap with pin in valve body, Fig. 9-32. Tap lightly on cap with a plastic or rawhide mallet until cap is against shoulder in valve body with valve body pin in cap groove. Hold these parts together during the rest of the assembly.

4. Lubricate valve spool with power steering fluid and slide over stub shaft with notch toward valve body. Align notch with spool drive pin in cap groove stub and carefully engage spool in valve body bore.

CAUTION: Because clearance between spool and valve body is very close, extreme care must be taken when assembling these parts. Push spool evenly and slowly with a slight twisting motion until it reaches drive pin. Rotate spool slowly with pressure until notch engages pin. Before pushing spool completely in, make sure dampener O-ring seal is evenly distributed in spool groove. Slowly push spool in completely, being careful not to cut or pinch O-ring seal by inserting spool beyond its normal position.

5. Slide spool spring over stub shaft and work spool spring down, using a small screwdriver, until spring is seated in stub shaft groove.

6. Lubricate new cap-to-worm O-ring seal with power steering fluid and install in valve body.

NOTE: Do not install upper thrust bearing assembly on valve assembly at this time.

d. Pitman Gear Shaft and Side Cover

Inspection

1. Inspect pitman shaft bearing surface in side cover for excessive wear or scoring. If badly worn or scored, replace side cover.

2. Visually inspect pitman shaft sector teeth and bearing and seal surface. If abnormally worn, pitted, or scored, replace pitman shaft.

3. Check pitman shaft for excessive wear or for broken spring as follows:

a. Clamp pitman shaft in a vise.

b. Using Torque Wrench, J-7754, and a 7/32 inch Allen socket, measure the torque required to turn the adjuster screw, Fig. 9-33. Torque reading should be between 1-15 inch-pounds. If reading is not within this range, the pitman shaft must be replaced.

e. Rack-Piston and Worm Assembly

Disassembly

1. Remove return guide clamp screws and remove clamp.

2. Place assembly on a clean cloth and remove ball return guides and Arbor, J-7539. Make sure all 24 balls are caught on the cloth, 22 balls on constant ratio steering gears.

NOTE: Rack-piston ring seldom needs to be replaced.

Inspection

1. Inspect worm and rack-piston grooves and all of the balls for excessive wear or scoring. If either worm or rack-piston needs replacing, both must be replaced as a matched assembly.

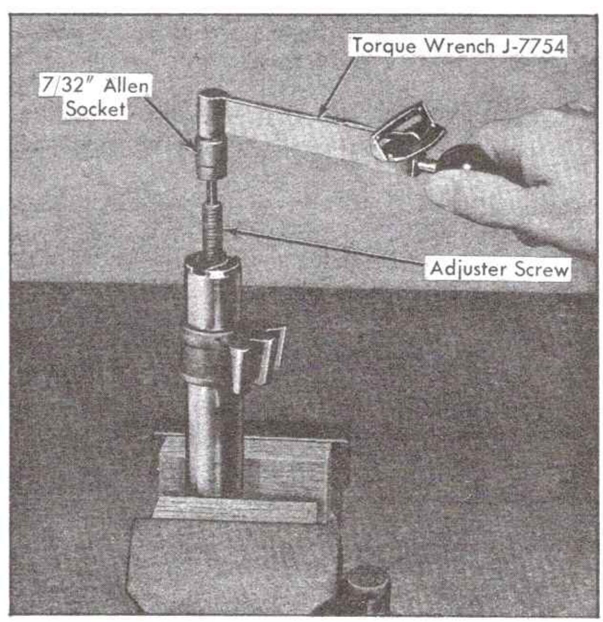


Fig. 9-33 Checking Pitman Shaft Adjuster Screw

NOTE: Service replacement balls are available in different sizes as described in this Note under "Assembly".

2. Inspect ball return guides, making sure that the ends where balls enter and leave the guides are not damaged.

3. Inspect lower thrust bearing and races for wear, pitting, scoring, or cracking. If any of these conditions are found, replace thrust bearing and races, and check worm.

4. Inspect rack-piston and end plug to be sure threads are not damaged.

5. Inspect rack-piston teeth for abnormal wear or scoring. Inspect rack-piston O.D. for abnormal wear, scoring, or burrs.

6. Visually inspect piston ring; if damaged, remove ring and back-up O-ring seal and discard.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. Lubricate new back-up O-ring seal, if necessary, with power steering fluid and install in piston ring groove on rack-piston. Do not allow seal to become twisted.

3. Install new piston ring, if necessary, in groove over O-ring seal.

4. Insert worm into end of rack-piston, from end opposite piston ring, until worm is against rack-piston shoulder.

5. Load 17 balls into guide hole nearest piston ring while slowly rotating worm counterclockwise to feed balls through circuit. Alternate black balls with white balls throughout the circuit.

6. Apply a liberal amount of petrolatum to one ball return guide and install the remaining balls into guide, 7 balls on variable ratio and 5 balls on constant ratio gears. Place the other guide over the balls and ball guide, and insert guides into guide holes of rack-piston. Make sure black ball in guide is installed next to white ball in rack-piston or vice versa. Guides should fit loosely. It is essential that all balls be positioned so that they are alternate in color. No two balls of the same color are to be side by side.

7. Place return guide clamp over guides and secure with two screws and lockwashers. Tighten screws to 12 foot-pounds.

8. Worm groove is ground with a high point in the center. When rack-piston passes over this high point, a preload of 1 to 4 inch-pounds should be obtained. To measure preload of worm and rack-piston ball assembly, proceed as follows:

a. Clamp rack-piston in a bench vise with soft jaws, with worm shaft pointing up. Do not distort rack-piston by over tightening vise.

b. Place valve assembly on worm, engaging worm drive pin.

c. Rotate worm until it extends 1 1/4 inches from rack-piston to thrust bearing face. This is center position.

d. Place Torque Wrench, J-7754, with a 3/4 inch 12-point socket on stub shaft, Fig. 9-34, and rotate wrench through an arc of approximately 60° in both directions several times, then take a torque reading. Highest average reading obtained with worm rotating should be between 1 and 4 inch-pounds.

e. If reading is below 1 inch-pound, a new set of balls must be installed upon reassembly.

Service replacement balls are available in sizes listed in the following chart:

Size Code	Mean Dia.	Size Range of Ball
7	.28125	.28120 - .28130
8	.28133	.28128 - .28138
9	.28141	.28136 - .28146
10	.28149	.28144 - .28154

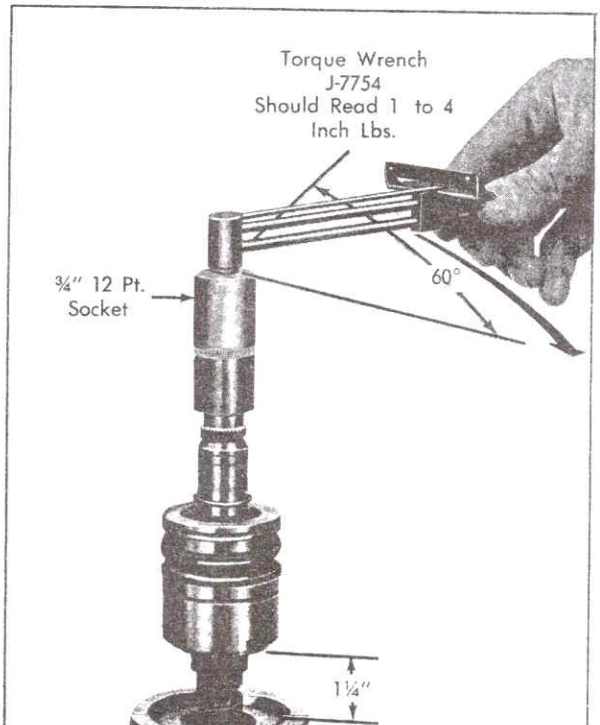


Fig. 9-34 Checking Worm and Rack Piston Ball Preload

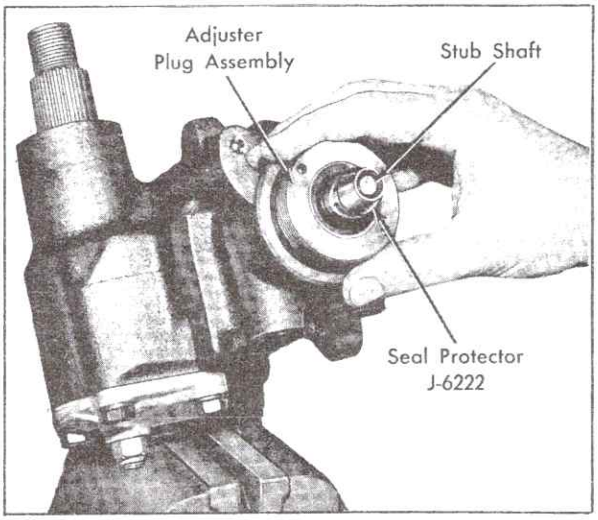


Fig. 9-35 Installing Adjuster Plug Assembly

Note the ball size stamped on the rack-piston and install the next size larger balls to increase the preload.

NOTE: If no number is found on the rack-piston, the original ball size was #7.

A change of one ball size (higher size code) will increase preload approximately 1 inch-pound. Final preload on replacement balls should be 2 to 3 inch-pounds.

9. Remove valve assembly from worm.

10. Remove rack-piston from vise.

11. Insert Worm Gear Ball Arbor, J-7539, into worm and turn rack-piston onto arbor. Do not allow arbor to separate from worm until rack-piston is fully on arbor.

14. Steering Gear, Installation of Major Components

1. Position gear housing in vise with adjuster plug end facing up.

2. Lubricate worm shaft, lower thrust bearing, and races with power steering fluid, then position thrust bearing and races on worm.

3. Align valve body drive pin on worm with narrow pin slot on valve body. Be sure O-ring seal between valve body and worm head is installed.

4. Position valve assembly and worm shaft in housing as an integral unit.

CAUTION: Do not push against stub shaft, as this might cause stub shaft and cap to pull out of valve body, allowing spool seal to slip into valve body oil grooves. Valve assembly can be installed by pushing on the outer diameter of the valve body housing with the fingers of both hands. Make certain that white plastic rings are not binding on inside of housing. Valve assembly is properly seated when oil return hole in gear housing is fully visible.

5. Place Adjuster Plug Seal Protector, J-6222, over end of stub shaft.

6. Lubricate new adjuster plug O-ring seal with power steering fluid and install in groove on adjuster plug.

7. Install adjuster plug assembly over end of stub shaft, Fig. 9-35, and tighten just enough to make certain that all parts are properly seated in gear housing. Remove Seal Protector J-6222.

NOTE: If Seal Protector J-6222 is removed too soon, stub shaft seal will be damaged by the shaft splines.

8. Install adjuster plug locknut loosely on adjuster plug.

NOTE: Do not adjust thrust bearing preload at this time.

9. Install Rack-Piston Seal Compressor, J-7576, in gear housing, Fig. 9-36, holding it tightly against shoulder in housing.

10. Insert rack-piston into housing until arbor engages worm. Turn stub shaft clockwise, using a 3/4 inch twelve-point socket or box end wrench, to draw rack-piston into housing. When piston-ring is in housing piston bore, Arbor J-7539, and Seal Compressor, J-7576, can be removed.

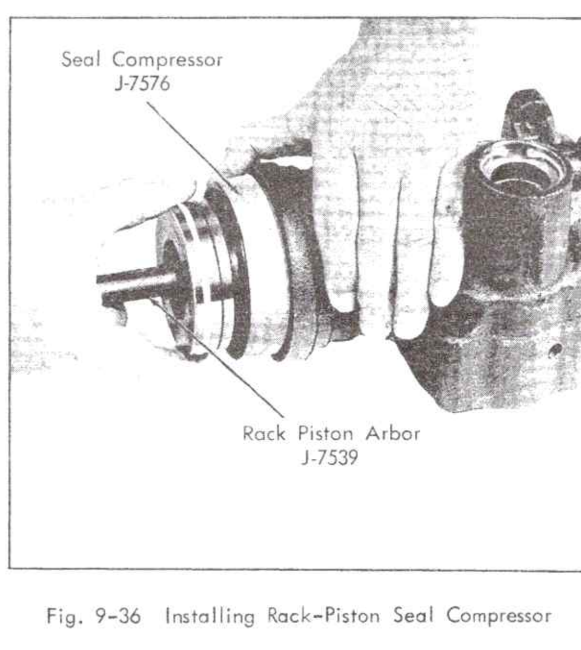


Fig. 9-36 Installing Rack-Piston Seal Compressor

11. Turn stub shaft as necessary until middle rack groove in rack-piston is aligned with center of pitman shaft needle bearing.

12. Lubricate new side cover O-ring seal and install in groove in face of side cover.

13. Assemble side cover on pitman shaft by screwing cover on to pitman shaft adjuster screw until side cover bottoms on pitman shaft, and back off 1/2 turn.

14. Install pitman shaft so that center tooth in sector meshes with center groove of rack-piston. Make sure side cover O-ring is in place before pushing side cover down on gear housing.

15. Install side cover screws and lockwashers and tighten to 35 foot-pounds.

16. Hold adjuster screw with Allen wrench and install new adjuster lock nut half way on adjuster screw.

17. Install rack-piston end plug in rack-piston. Tighten end plug to 75 foot-pounds.

18. Lubricate new housing end plug O-ring seal with power steering fluid and install in gear housing.

19. Insert end plug into gear housing and seat against O-ring seal. Slight tapping with a mallet may be necessary to seat end plug properly.

20. Snap end plug retainer ring into place with fingers. Slight tapping may be required to bottom retainer ring in the gear housing securely.

21. Position gear assembly with stub shaft end up and adjust thrust bearing preload as follows:

a. Using Spanner Wrench, J-7624, lightly tighten adjuster plug and then back off 1/8 turn.

b. Install 0-25 inch-pound Torque Wrench, J-7754, with a 3/4 inch 12-point socket on stub shaft splines, Fig. 9-37.

c. Rotate stub shaft to either the left or right turn stop and then back off from stop 1/2 turn.

d. Rotate torque wrench in a 45° arc and note highest reading.

e. Tighten adjuster plug with Spanner Wrench, J-7624, until there is a preload of 1-3 inch-pounds higher than initial load reading just measured.

f. Tighten adjuster plug locknut securely with punch and hammer.

g. Recheck preload to be sure it still reads 1-3 inch-pounds higher than initial load. If adjustment has changed, readjust.

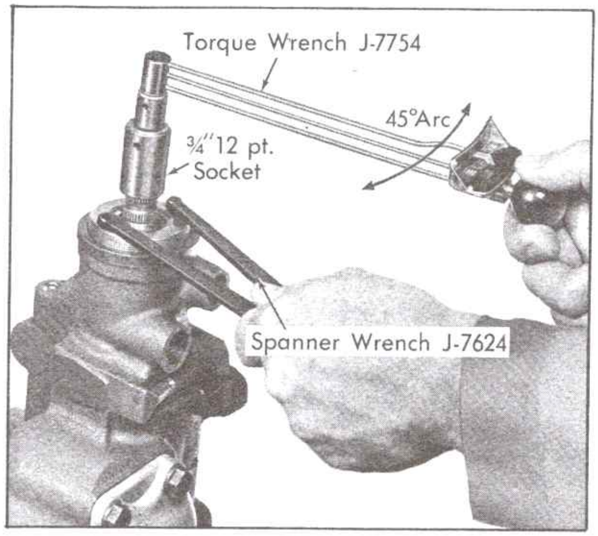


Fig. 9-37 Adjusting Thrust Bearing Preload

22. Adjust pitman shaft end play as follows:

a. Rotate stub shaft from one stop to the other and locate center of travel.

b. With gear on center, check combined ball and thrust bearing preload with Torque Wrench, J-7754, with a 3/4 inch 12-point socket, and note highest reading, Fig. 9-38.

c. With pitman gear on center and adjuster screw locknut backed off, adjust pitman shaft so that preload is 8-10 inch-pounds in excess of total preload and drag.

NOTE: These readings should be made by rotating torque wrench in a circle. Total preload of gear should not exceed 20 inch-pounds.

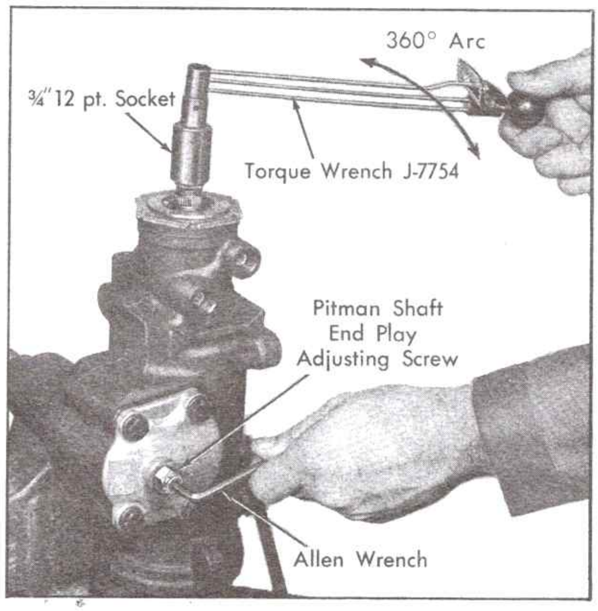


Fig. 9-38 Adjusting Pitman Shaft End Play

d. With gear on center and reading achieved, tighten adjuster screw locknut to 30 foot-pounds.

23. Install flexible coupling flange assembly on stub shaft and install flange screw in coupling, making certain metal section of coupling is not touching adjuster plug. Tighten screw to 30 foot-pounds.

15. Steering Gear Hose Connector Seats and Poppet Check Valve Replacement

The following procedure can be performed on car as well as on bench.

1. Disconnect pressure and return line hoses at steering gear and secure hose ends in a raised position to prevent loss of fluid.

2. To prevent metal chips from becoming lodged in valve assembly, pack inside of connector seats and pressure and return port housings with petrolatum.

3. Tap threads in connector seats, using a 5/16-18 tap.

CAUTION: Do not tap threads too deep in pressure hose connector seat as tap will bottom poppet valve against housing and damage it. It is necessary to tap only 2 or 3 threads deep.

4. Thread a 5/16-18 bolt with a nut and flat washer into tapped hole, Fig. 9-39.

5. To pull connector seat, hold bolt from rotating while turning nut off bolt. This will pull connector from housing. Discard connector seat.

NOTE: It is also possible to remove connector by using a No. 4 screw extractor.

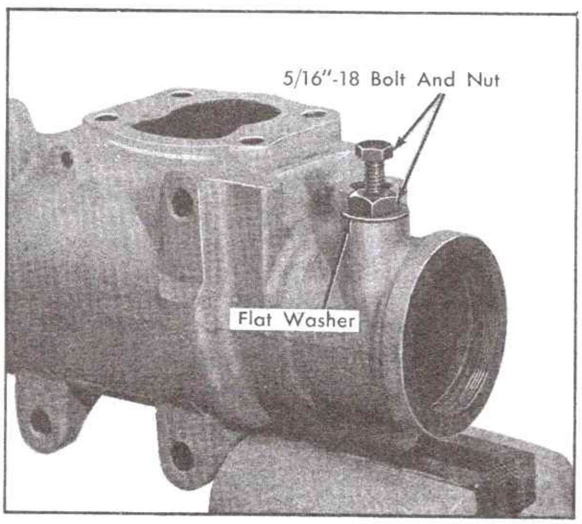


Fig. 9-39 Removing Hose Connector Seat With Bolt

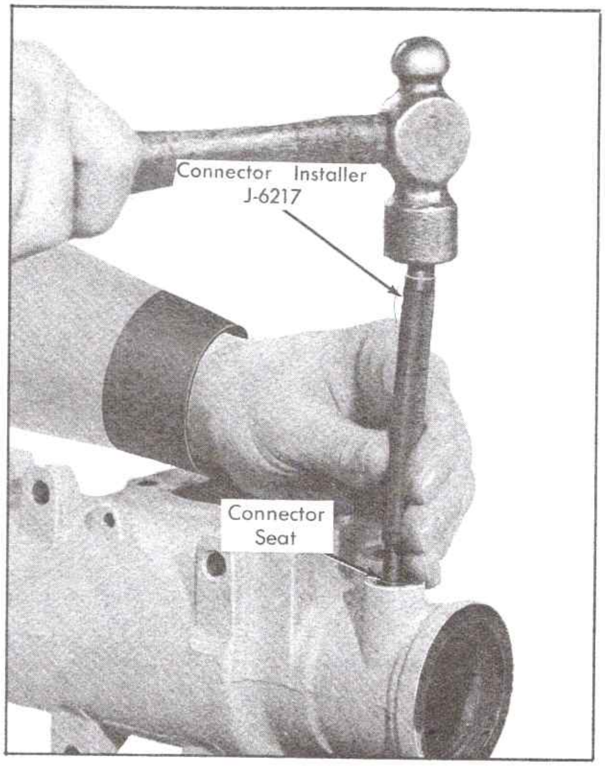


Fig. 9-40 Installing Hose Connector Seat

6. Wipe grease from housing, and clean housing thoroughly to remove any metal chips or dirt.

7. Remove poppet check valve and spring from pressure port and discard.

8. Install new check valve spring in pressure port with large end down. Make sure spring is seated in counterbore in pressure port.

9. Install new check valve over spring with tangs pointing down. Make sure valve is centered on small end of spring.

10. Install new connector seats, using petrolatum to hold connector seat on check valve in pressure port. Drive connector seats in place using Valve Connector Seat Installer, J-6217, Fig. 9-40.

11. Check operation of valve by pushing lightly against valve with a pencil point or small rod. Valve should reseat itself against connector seat when pressure is removed from spring.

12. Connect pressure and return line hoses on steering gear. Tighten hose fittings to 25 foot-pounds.

13. Check fluid in pump reservoir and add if necessary.

16. Pitman Shaft Seal Replacement

When inspection indicates that a pitman shaft seal is leaking, it is necessary to remove steering gear from car in order to replace seal. Proceed as follows:

a. Removal

1. Remove steering gear as described in Note 11a.

2. Remove pitman shaft seal retaining ring from gear housing, using Snap Ring Pliers, J-4245 (#3), and then remove outer back-up washer.

3. Insert a screwdriver between outer seal and inner back-up washer, pry out seal, and remove back-up washer.

4. Insert screwdriver between inner seal and shoulder in gear housing and pry out seal. Be careful not to damage seal bore.

5. Inspect seals for damage. If O.D. appears scored, inspect housing for burrs and remove.

NOTE: Always discard used seals and install new seals.

b. Installation

1. Clean end of pitman shaft bore to prevent entrance of dirt into housing or damage to seals as they are installed.

2. Wrap tape around splines of pitman shaft to prevent damage to seals as they are installed. Use only one layer of tape to assure adequate clearance for seals.

3. Install seals as explained in Note 13a, steps 3, 4, 5, and 6, under "Assembly".

4. Replace pitman arm on pitman shaft and install lockwasher and pitman arm retaining nut. Tighten nut to 140 foot-pounds.

5. Install steering gear as described in Note 11b.

6. Connect pitman arm to drag link and install nut and cotter pin. Tighten nut to 40 foot-pounds.

7. Check fluid level and bleed hydraulic system as described in Note 1.

17. Steering Wheel

a. Removal

CAUTION: Under no circumstances should the steering shaft be struck on the end in an effort to remove the steering wheel. This action will damage delicate parts of the steering column.

1. Remove three screws from back of spokes and lift pad assembly from wheel.

2. On Tilt and Telescope wheel proceed with steps 3 thru 5. On standard wheels proceed to step 6.

3. Remove three screws securing lever and knob assembly to flange and screw assembly.

4. Unscrew flange and screw assembly from steering shaft and remove.

5. Remover lever and knob assembly.

6. Scribe an alignment mark on steering wheel hub in line with slash mark on steering shaft to be used at time of installation.

7. Loosen nut on steering shaft positioning it flush with end of shaft.

8. Carefully install Steering Wheel Puller, J-1859-02 with two 5/16"-18 x 4" bolts. Snug center bolt of puller against steering shaft nut.

CAUTION: Do not tighten center bolt of puller with a wrench as this action can cause damage to threads on steering shaft.

9. Tighten 5/16"-18 bolts alternately until steering wheel is loose on shaft, Fig. 9-41.

10. Remove puller.

11. Remove steering shaft nut.

12. Lift wheel off steering shaft.

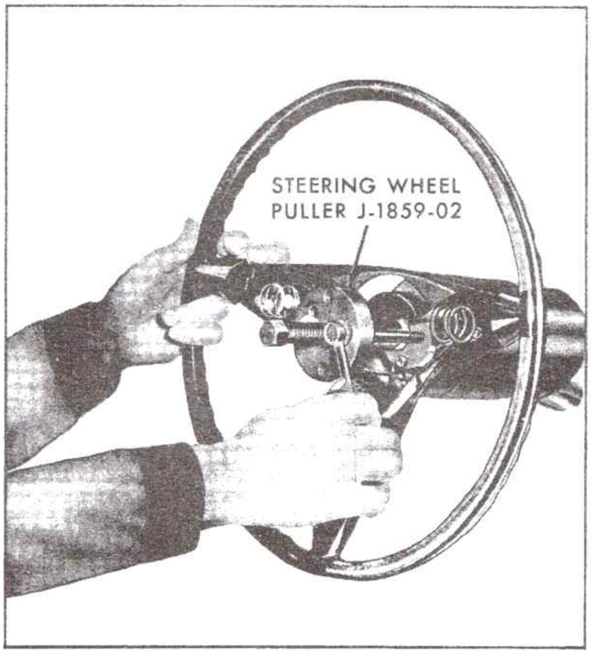


Fig. 9-41 Removing Steering Wheel

b. Installation

1. Install steering wheel, aligning scribe mark on hub with slash mark on end of shaft.

CAUTION: The steering wheel should not be driven on the steering shaft. This action will cause damage to the steering column components.

2. Install steering shaft nut and tighten it to 35 foot-pounds.

3. On Tilt and Telescoping wheels proceed to steps 4 through 7. On standard wheels proceed to step 8.

4. Install lever and knob assembly on steering wheel.

5. Screw flange and screw assembly finger tight into steering shaft.

6. Position lever and knob assembly against flange and screw assembly and secure with three screws.

7. Check operation of telescoping mechanism by rotating locking lever against stops. Check to see that wheel is free to telescope in left position and is securely locked in right position. If necessary, readjust as described in steps 5 and 6.

8. Position three springs on spokes of wheel.

9. Position pad assembly on wheel and secure with three screws from rear side of wheel.

c. Alignment

In the event the steering wheel is "off-center" when the car is being driven down the road, it will be necessary to align steering wheel or front wheels as described below:

1. Check steering wheel for proper position on steering shaft. With steering wheel "centered" in car, slot in flexible coupling upper shaft flange should be facing upward with scribe mark in upper end of steering shaft at "6 o'clock". If necessary reposition steering wheel on shaft.

2. Drive car on a straight flat road to determine whether or not steering wheel is still "off-center".

3. If steering wheel is still "off-center", mark top of the wheel with a small piece of tape or crayon for reference when making correction.

4. If steering wheel measures more than 2 inches "off-center" at the rim, it can be centered by repositioning wheel one serration on steering shaft.

NOTE: Before removing steering wheel, scribe a mark on hub and shaft as a reference to its original position.

5. If steering wheel is more than 2 inches "off-center", set wheel straight ahead and adjust tie rods. Shorten left tie rod and lengthen right tie rod if wheel is to the left of center, or shorten right tie rod and lengthen left tie rod if the wheel is to the right of center. Be careful not to damage joint seals when adjusting tie rods.

NOTE: Tie rod adjustment should be made on a wheel alignment machine so that correct toe-in setting is maintained.

18. Steering Column Removal and Installation

a. Removal

1. Remove screw and lockwasher that secures flexible coupling to steering shaft on all cars except 693. Remove lower steering shaft as described in Note 27a on 693.

2. Remove one bolt and lockwasher that secures shift lever to transmission linkage under hood.

3. Remove three screws and flatwashers that secure lower steering clamp to cowl.

CAUTION: Lower clamp must be removed before removing upper brackets as weight of column will bend column.

4. Remove one screw and lockwasher that secure lower clamp to steering column jacket.

5. Remove steering column lower cover as described in Section 12, Note 38a.

6. Remove transmission shift indicator pointer by using an Allen wrench to loosen set screw.

7. Disconnect two multiple connectors under dash panel.

8. Disconnect connectors and vacuum hoses from neutral safety and back-up light switch assembly.

9. Pull up on rubber cover and remove three carpet to floor attaching screws to gain access to toe pan seal, and retainer.

10. Remove five screws that secure retainer to toe pan.

11. Remove four screws and flatwashers that secure cradle to steering column jacket.

12. Remove four screws and flatwashers that secure cradle to dash panel. Remove cradle and store it and bolts in a safe place.

13. Carefully pull steering column up and out of car. Be careful not to damage neutral safety and back-up light switch.

b. Installation

1. With toe pan seal and retainer in position on column, carefully install steering column into position through floor guiding lower steering shaft into flexible coupling flange so that flat on shaft aligns with flat in coupling flange.

CAUTION: Cradle must be loosely installed before installing lower clamp so weight of column will not bend column.

2. Position cradle and loosely install four screws and flatwashers that secure cradle to dash panel. Do not substitute screws.

3. Install four screws and flatwashers that secure cradle to steering column jacket. Tighten screws to 30 foot-pounds.

NOTE: If the 5/16"-18 threads in the steering column tapping plates have been stripped, they may be retapped using a 3/8"-16 tap. Use lubriplate to make sure metal chips do not enter steering column. Replace the 5/16"-18 screws with 3/8"-16 screws of the same length.

4. Position lower clamp on cowl and loosely install with three screws and flatwashers.

5. Install one screw and lockwasher that secures lower clamp to steering column jacket. Tighten screws to 30 foot-pounds.

6. Tighten three lower clamp to cowl screws to 30 foot-pounds.

7. Align toe pan seal and retainer with column and floor and secure with five screws.

8. Replace carpet and secure with three screws. Slide steering column rubber cover in place.

9. Install screw and lockwasher securing flexible coupling to lower steering shaft, tightening screw to 30 foot-pounds on all cars except 693. Install lower steering shaft as described in Note 27b on 693.

10. Install one screw and lockwasher that secures shift lever to transmission linkage.

11. Connect wire connectors and vacuum hoses at neutral safety switch and back-up light switch assembly.

12. Connect two multiple connectors under dash panel.

13. Install transmission shift indicator and tighten hex head set screw with Allen wrench.

14. Adjust neutral safety and back-up light switch as described in Section 12, Note 24c.

15. Perform transmission linkage adjustment as described in Section 7, Note 4 on all but 693 and Note 22 on 693.

16. Install steering column lower cover as described in Section 12, Note 38b.

19. Standard Steering Column Disassembly, Inspection and Assembly

NOTE: Extreme care must be taken when working on the column as certain parts of the assembly can be damaged if not handled correctly.

a. Disassembly

1. Remove steering column as described in Note 18a.

2. Position steering column in Holding Fixture, J-22573, Fig. 9-42.

3. Remove steering wheel as described in Note 17a.

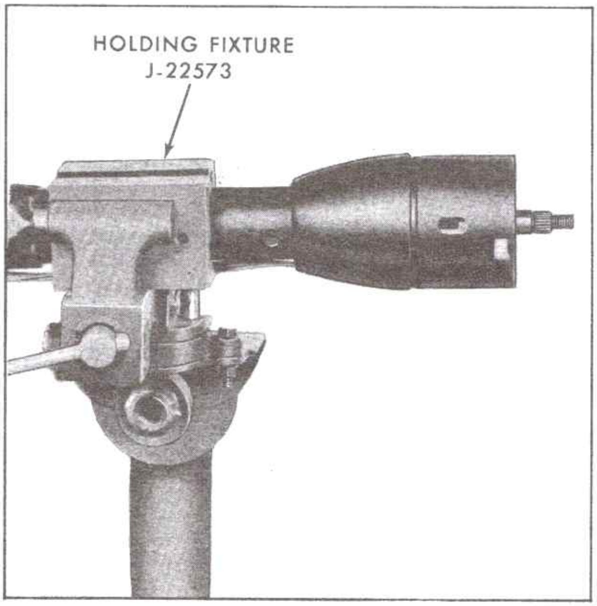


Fig. 9-42 Positioning Holding Fixture on Column

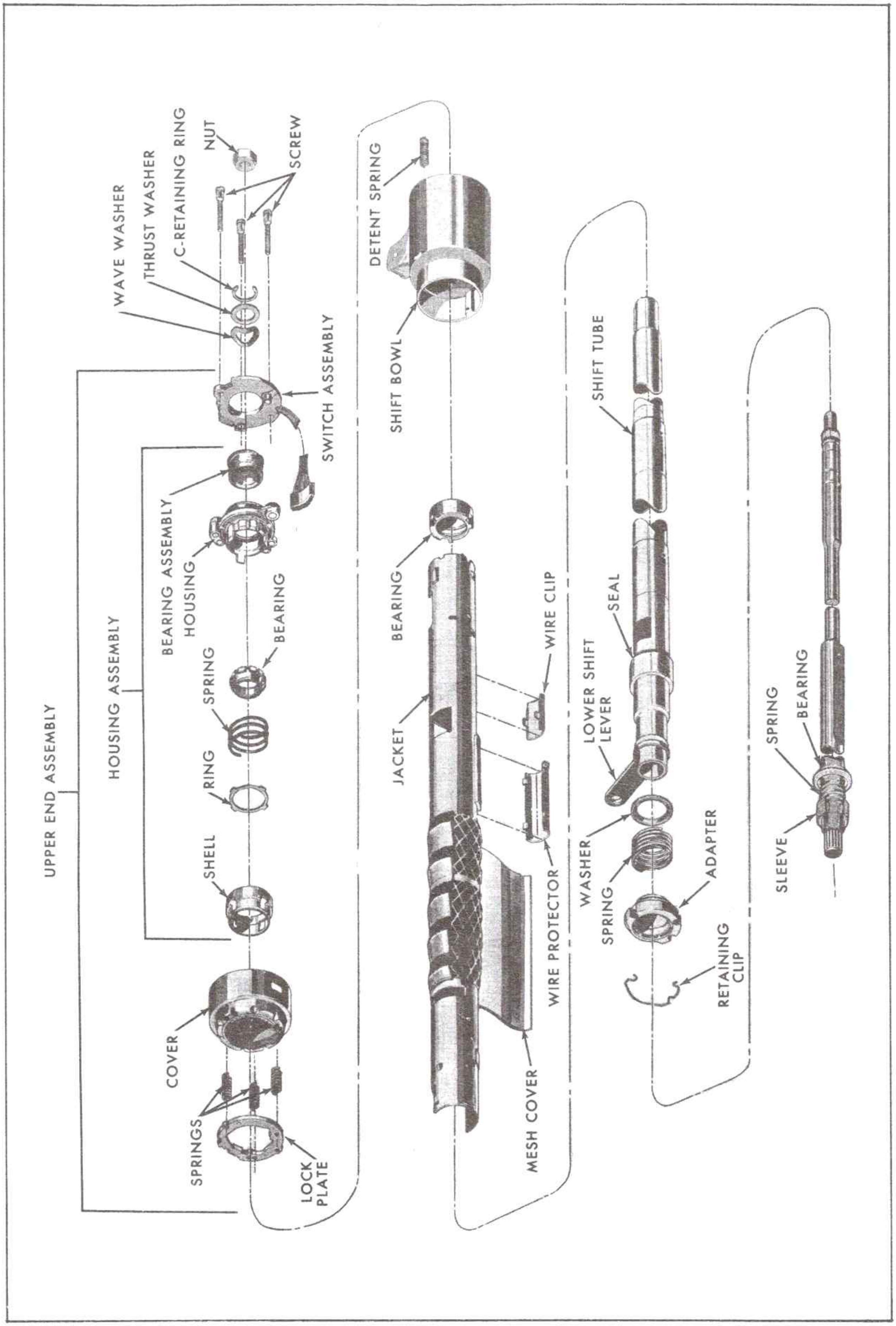


Fig. 9-43 Steering Column Disassembled

4. Slide upper bearing preload spring and turn signal cancelling cam off steering shaft.

5. Remove turn signal lever screw and lever.

6. Remove cap from hazard warning switch button.

7. Push hazard warning switch button in and, removing screw, remove button.

8. If repair to the bowl is necessary, support upper end of steering column and drive out shift lever pivot pin and remove shift lever.

9. Remove wire clip and protector from column. Do not pry against wire to remove.

10. Remove snap ring from steering shaft by engaging it with Snap Ring Remover and Installer J-22569 and turning tool to force snap ring sideways out of groove, Fig. 9-44.

11. Slide thrust washer and wave washer off steering shaft.

12. Loosen three switch mounting screws until assembly can be rotated counterclockwise. It may be necessary to push on top of screws to loosen assembly.

13. Rotate cover assembly counterclockwise and pull assembly off top of jacket.

14. Remove cover assembly and shift bowl from steering column and separate.

15. Remove three mounting screws completely from engagement with lock plate.

16. Remove switch and housing assemblies from cover and separate them.

17. If shift lever spring requires replacement, pry it from shift bowl and discard. Do not reuse this spring once it has been removed.

18. Pull steering shaft from bottom of column.

19. Remove two screws holding neutral-safety switch and remove switch.

20. Remove lower bearing adapter retaining clip.

21. Remove bearing adapter, bearing and shift tube spring. Bearing may be pressed out of adapter for replacement by pressing lightly against outer race.

22. Remove shift tube from column.

23. Remove bearing from jacket using a long wooden dowel to engage bearing from lower side and driving bearing from top of jacket.

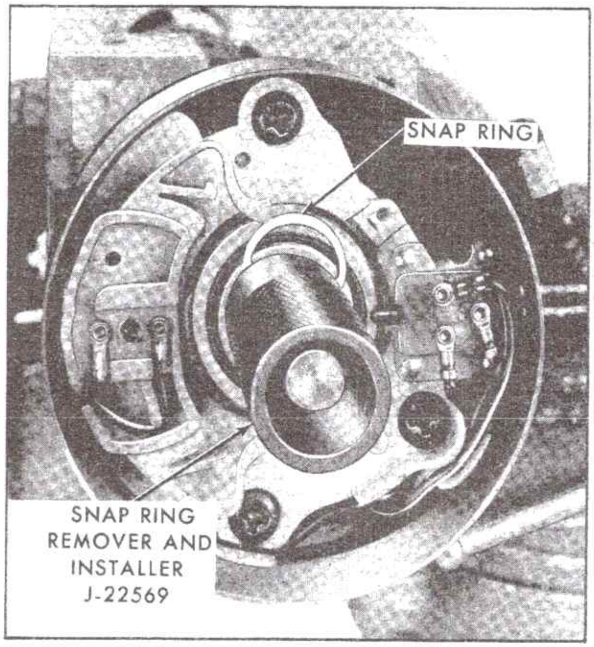


Fig. 9-44 Removing Snap Ring

24. Mesh cover may be removed from jacket by running the back of a knife blade between the overlap of fabric and then unwrapping the cover.

b. Inspection

1. Inspect all bearings for wear, roughness and binding. Make certain that bearings are adequately lubricated with Lithium base (ball joint) grease. Do not over lubricate.

2. Inspect cam for wear and breakage. Replace if necessary.

3. Inspect horn contact button and spring for breakage. Replace switch assembly if broken.

4. Inspect switch wires for chafing. Repair, if necessary, or replace switch.

5. Inspect switch housing for breakage.

6. Inspect all other parts for breakage or wear. Replace as necessary.

7. Inspect steering shaft, shift tube and jacket for visible signs of deformation, shortened, lengthened or bent.

c. Assembly

1. Rewrap mesh cover if removed. Use electrical or friction tape to hold in place.

2. Install bearing in jacket by pressing it in using Bearing Installer, J-22572 Fig. 9-45. Do not hammer in place as damage to column may result.

3. If removed from adapter, press lower bearing into adapter assembly.

4. Install shift tube spring and bearing adapter on lower end of shift tube and slide shift tube into jacket assembly.

5. Install retaining clip to hold bearing adapter in place on lower end of jacket.

6. Loosely install neutral-safety switch on jacket.

terference with shift tube may result.

7. Install steering shaft into column.

8. Install sleeve assembly on steering shaft. If any of the following parts in the column have been replaced or there is excessive play in steering shaft, replace the sleeve assembly:

a. Steering shaft assembly.

b. Adapter assembly.

c. Jacket.

d. Bearing housing.

9. If removed, press a NEW shift lever spring into shift bowl pocket.

10. Set switch assembly on top of housing and feed wires through cover.

11. Align switch, housing and cover holes and install three mounting screws through holes.

12. Slide three springs onto screws and start

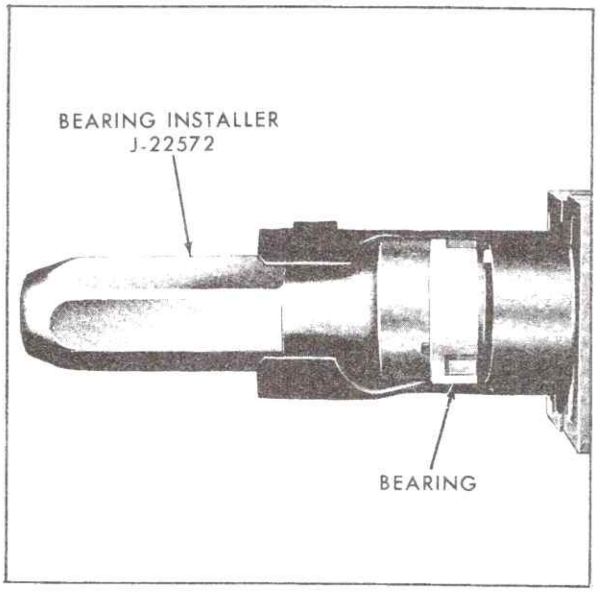


Fig. 9-45 Installing Bearing in Jacket

screws into lock plate. Turn screws only three turns for ease of further assembly.

13. Run switch wires through shift bowl assembly and place upper end assembly on top of bowl.

14. Making sure tangs on ID of lock plate are aligned with slots in jacket, position bowl and upper end assembly on top of jacket.

15. Push down on assembly and rotate it fully clockwise, securing it to jacket.

16. Tighten three mounting screws to 35 inch-pounds.

17. Lay wiring flat against jacket and install wire clip and protector.

18. Slide wave washer and thrust washer over steering shaft and against bearing.

19. Shift steering shaft as far upward as possible and, holding it in that position, start snap ring against steering shaft taper and slide it down steering shaft with Snap Ring Installer, J-22569, until it snaps in groove. Completely seat snap ring in groove by sliding it sideways.

20. Install turn signal lever and screw, tightening screw to 30 inch-pounds.

21. Install hazard warning knob and screw, tightening screw to 8 inch-pounds.

22. Snap cover on hazard warning knob.

23. Install cancelling cam and upper bearing spring on steering shaft.

24. Install steering wheel as described in Note 17b.

25. If sleeve assembly is being replaced, adjust it as follows:

a. Adjust sleeve assembly by turning the inner sleeve until outer sleeve is finger tight and there is no lash present.

CAUTION: Do not overtighten or steering shaft assembly will be damaged.

b. Using a hot iron, fuse the sleeves together in three places equally spaced approximately 1/8 inch wide.

26. Install steering column as described in Note 18b.

20. Standard Steering Column Lower Bearing

a. Removal

1. Remove steering column as described in Note 18a.

2. Perform steps 21 and 22 of Note 19a.

b. Installation

1. Perform steps 3, 4, 5, 8 and 26 of Note 19c.

2. Install steering column as described in Note 18b.

21. Standard Steering Column Upper Bearing

a. Removal

1. Remove steering column as described in Note 18a.

2. Perform steps 3 through 18 of Note 19a.

b. Installation

1. Perform steps 8 through 25 of Note 19c.

2. Install steering column as described in Note 18b.

22. Steering Linkage Removal, Disassembly, Assembly, and Installation

a. Removal

1. Remove cotter pins and nuts from outer tie rod pivots at steering arms.

2. Remove tie rod pivots from steering arms, using Tie Rod End Puller, J-21930, Fig. 9-46. Be careful not to damage joint seals.

3. Remove idler arm support mounting screws and lock washers from frame side member.

4. Remove pitman arm cotter pin, nut and washer at steering linkage, Fig. 9-9.

5. Break pitman arm loose from steering linkage, using puller tool, J-8990.

6. Remove drag link with tie rods attached.

b. Disassembly

1. Remove cotter pins and nuts from idler arm pivot and both inner tie rod pivots.

2. Remove tie rods, using Tie Rod End Puller, J-21930, Fig. 9-47.

3. Remove idler arm from drag link, using Puller, J-8990.

4. Remove dust seals from pitman arm and idler arm pivot studs.

5. Remove tie rod outer pivots by loosening nuts on outer clamp bolts and unscrewing tie rod outer pivots from adjuster tubes. Be careful not to pinch joint seals between stud and socket.

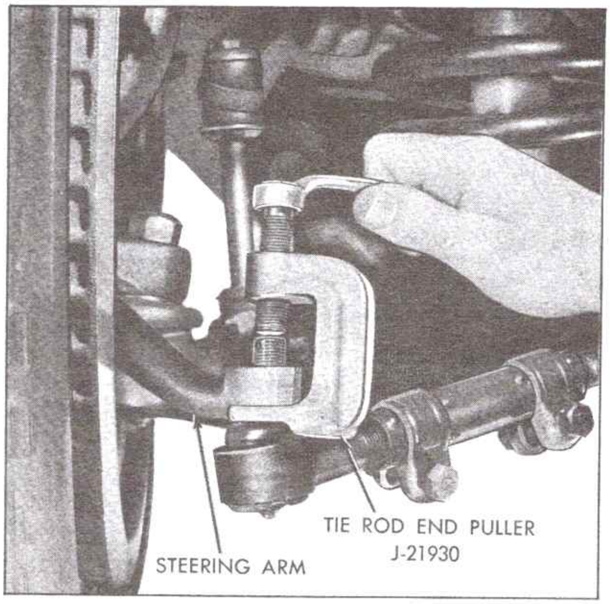


Fig. 9-46 Removing Tie Rod From Steering Arm

6. If necessary, remove clamps and adjuster tubes from ends of tie rods.

c. Assembly

1. If previously removed, lubricate adjuster tubes with chassis lubricant, install adjuster tubes and clamps on ends of the rods.

2. Thread tie rod outer pivots into adjuster tubes, but do not tighten outer clamps.

3. Install both tie rods on drag link, tightening nuts to 40 foot-pounds, and install cotter pin.

4. Install new dust seal on idler arm pivot stud and install idler arm on drag link. Tighten nuts to 35 foot-pounds, and install cotter pin.

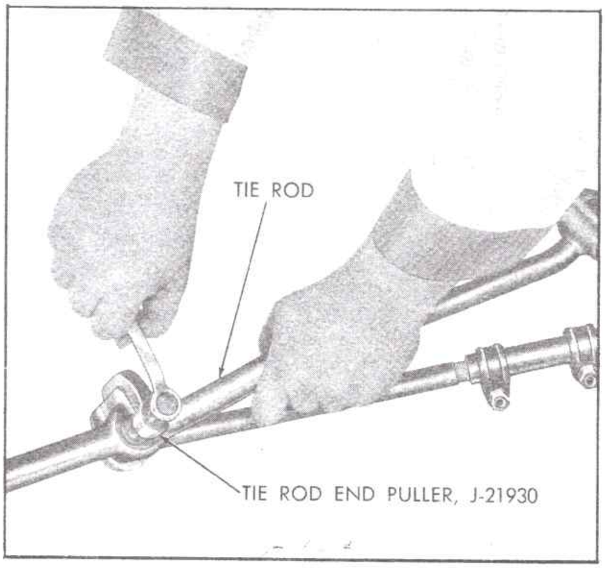


Fig. 9-47 Removing Tie Rod From Drag Link

NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 40 foot-pounds.

5. Install new dust seal on pitman arm pivot stud.

d. Installation

1. Install idler arm support on frame side bar with two mounting screws and lock washers. Tighten mounting screws finger tight.

2. Install pitman arm at drag link stud. Tighten nut to 35 foot-pounds and install cotter pin.

NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 40 foot-pounds.

3. Connect tie rod pivots to steering arms, tighten nuts to 35 foot-pounds and install cotter pins.

NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 40 foot-pounds.

4. Turn steering wheel back and forth through the straight ahead position (without touching wheel stops) to align linkage. Then tighten idler arm bracket to frame attaching screws to 35 foot-pounds.

5. Adjust toe-in as described in Section 3, Note 1c.

DIAGNOSIS CHART

(See Page 9-44 for diagnosing Tilt and Telescope steering wheel)

CONDITION		CAUSE	CORRECTION
Pump Noise	Chirp	Loose belt.	Tighten belt.
	Squeal	Loose belt.	Tighten belt.
	Rattle	Pressure hose touching other parts of car.	Adjust hose position.
	Groan	Low oil level.	Fill reservoir.
	Groan	Air in the oil. Poor pressure hose connection.	Bleed system by operating steering from right to left - full turn.
	Growl	Excessive back pressure caused by hoses or steering gear.	Locate restriction and correct. Replace part, if necessary.
	Growl	Scored pressure plates, thrust plate or rotor.	Replace with new part.
	Rattle	Vanes not installed properly.	Install properly.
	Rattle	Vanes sticking in rotor slots.	Free up by removing burrs, varnish or dirt.
	Growl	Extreme wear of cam ring.	Replace part.
	Swish	Defective flow control plunger.	Replace part.
	Whine	Pump shaft bearing scored.	Replace housing and shaft
Excessive Wheel Kick-Back or Loose Steering		Backlash in steering linkage.	Adjust parts affected or replace worn parts.
		Air in system.	Add oil to pump reservoir and bleed by operating steering.
		Excessive "on-center" lash.	Adjust as required, see Note 5c.

DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive Wheel Kick-Back or Loose Steering (Cont'd)	Loose thrust bearing preload adjustment.	Adjust as required, see Note 5a.
	Worm and ball preload.	Remove rack-piston and worm. Inspect for worn parts and replace as necessary.
	Worn poppet valve.	Replace valve. See Note 15.
	Steering gear loose on frame.	Tighten attaching screws to 60 foot-pounds.
	Steering gear flexible coupling too loose on shaft or rubber disc mounting rivets or screws loose.	Tighten retaining screws to 30 foot-pounds. Replace coupling if rivets are loose. Tighten mounting bolts to 15 foot-pounds on 693.
	Steering linkage spherical joints worn enough to be loose.	Replace loose pivots.
	Front wheel bearings incorrectly adjusted or worn.	Adjust bearings or replace with new parts as necessary.
Poor Return of Steering	Frozen steering shaft bearings.	Replace bearings.
	Lower coupling flange rubbing against steering gear adjuster plug or Cruise Control cables.	Loosen screw and assemble properly.
	Steering wheel rubbing against directional signal housing.	Adjust steering jacket.
	Tires over-inflated.	Inflate to specified pressure.
	Steering linkage binding.	Replace pivots.
	Steering gear to column misalignment.	Align gaging position of flexible coupling. See Note 7.
	Tie rod pivots not centralized.	Adjust tie rod ends as required to center pivots.
	Lack of lubricant in suspension spherical joints.	Replace seal and repack.
	Steering gear adjustments tight.	Check adjustment with pitman arm disconnected. Readjust if necessary.
	Sticky or plugged valve spool.	Remove and clean or replace valve.
	Rubber spacer binding in shift tube.	Make certain spacer is properly seated. Lubricate inside diameter with silicone.
	Tight steering shaft bearings.	Replace bearings.
	Improper front wheel alignment.	Check and adjust as necessary.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Poor Return of Steering (Cont'd)	Steering shaft rubbing ID of shift tube.	Align column.
Steering Gear External Oil Leaks (Wipe gear thoroughly and make sure source of leakage is determined)	Loose hose connections.	Tighten.
	Damaged hose or connector seat.	Replace hose.
	Side cover O-ring seal.	Replace seal.
	Pitman shaft seals.	Replace seals.
	Housing end plug seal.	Replace seal.
	Adjuster plug seals.	Replace seals.
	Torsion bar seal.	Replace complete valve assembly.
	Defective housing.	Replace housing.
Gear Noise (Rattle or Chuckle)	Loose pitman shaft adjustment.	Adjust to specifications.
	NOTE: A slight rattle may occur on turns because of increased clearance off the "high point". This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle.	
	Gear loose on frame.	Check gear-to-frame mounting screws. Tighten screws to 60 foot-pounds.
	Steering linkage looseness.	Check linkage pivot points for wear. Replace if necessary.
Car Leads to One Side or the Other. (Keep in mind road condition and wind. Test car on flat road going in both directions)	Front end misaligned.	Adjust to specifications.
	Unbalanced or badly worn valve.	Replace valve.
	NOTE: If this is cause, steering effort will be very light in direction of lead and heavy in opposite direction.	
	Steering linkage not level.	Adjust as required, see Note 6.
Steering Wheel Surges or Jerks When Turning With Engine Running, Especially During Parking	Loose pump belt.	Adjust tension.
	Sticky flow control valve.	Inspect for varnish or damage, replace if necessary.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Steering Wheel Surges or Jerks (Cont'd)	Steering linkage hitting engine oil pan at full turn.	Correct clearance.
Pump Leaks	Top of reservoir:	
	Reservoir too full.	Fill to proper level.
	Air in oil.	Bleed system by operating steering.
	At reservoir:	
	O-ring cut.	Replace O-ring.
	O-ring improperly installed.	Install properly.
	At pressure union or cover screw:	
	Not tightened sufficiently.	Torque to specifications.
	Cross threaded or damaged seat.	Replace damaged parts.
	Defective seat on hose end.	Replace hose.
	Damaged seals.	Replace seals.
	Loose hose connections.	Tighten to specifications.
	At shaft seal:	
	Defective seal.	Replace seal without disassembling any other part of the pump.
	Damaged shaft.	Replace shaft. Inspect housing bushing for wear.
	Leaks in metal part.	Replace defective part.
Momentary Increase in Effort When Turning Wheel Fast to Right or Left.	Low oil level in pump.	Check oil level in pump reservoir.
	Pump belt slipping.	Tighten or replace belt.
	High internal leakage.	Check pump pressure, Note 2.
Hard Steering or Lack of Assist	Loose pump belt.	Adjust to specifications.
	Low oil level in reservoir.	Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Hard Steering or Lack of Assist (Cont'd)	Lack of lubricant in suspension spherical joints.	Replace seal and repack spherical joint.
	Tires not properly inflated.	Inflate to recommended pressure.
	Flexible coupling distorted.	Loosen bolts and assemble properly.
	Steering gear to column misalignment.	Align gaging position of flexible coupling, see Note 7.
	Improper front and rear wheel alignment.	Check and adjust as necessary.
	Steering gear adjusted too tight.	Test steering system for binding with front wheels off floor. Adjust as necessary.
	Excessive friction in steering linkage.	Check tie rod pivot points for excessive friction. Replace the affected pivot.
	Excessive caster or toe-in.	Adjust caster and toe-in to specifications.
	Incorrect camber.	Check and adjust to specifications.
	Suspension arms bent or twisted.	Check wheel camber and caster. Replace bent arms with new ones.
	Lower spherical joints too tight.	Replace joints.
	Upper spherical joints too tight.	Replace arm assembly.
	Steering knuckle bent.	Replace with new knuckle.
	Frame bent or cracked.	Check frame for proper alignment or cracking. Repair or replace as necessary.
	Front springs weak and sagging.	Check spring height. Weak or sagging springs should be replaced with new ones.
	Insufficient oil pressure.	If above checks do not reveal cause of hard steering, check pump pressure, Note 2.
	Low oil pressure due to restriction in hoses:	
	Check for kinks in hoses.	Remove kink.

DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Hard Steering or Lack of Assist (Cont'd)	Foreign object stuck in hose.	Remove hoses and remove restricting object or replace hose.
	Low oil pressure due to steering gear:	
	Pressure loss in cylinder due to worn piston ring or scored housing bore.	Remove gear from car for disassembly and inspection of ring and housing bore.
	Leakage at valve rings, valve body to worm seal.	Remove gear from car for disassembly and replace seals.
	Loose fit of spool in valve body or leaky valve body.	Replace valve.
	Damaged poppet valve.	Replace valve, see Note 15.
	Low oil pressure due to steering pump:	
	Loose drive belt.	Tighten belt.
	Low oil level.	Fill reservoir.
	Air in the oil.	Locate source of leak and correct. Bleed system.
	Defective hoses or steering gear.	Correct as necessary.
	Flow control valve stuck or inoperative.	Remove burrs or dirt or replace.
	Loose screw in end of flow control valve.	Tighten.
	Pressure plate not flat against cam ring.	Correct.
	Extreme wear of cam ring.	Replace part.
	Scored pressure plate, thrust plate or rotor.	Lap away light scoring. Replace heavily scored parts.
	Vanes not installed properly.	Install properly.
	Vanes sticking in rotor slots.	Free-up by removing burrs, varnish or dirt.
Gear Noise ("Hissing" Sound)	There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Do not replace valve unless "hiss" is extremely objectionable. Slight "hiss" is normal and in no way affects steering. A replacement valve will also exhibit slight noise and is not always a cure for the objection. Investigate clearance around flexible coupling screws. Be sure steering shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal-to-metal contact through flexible coupling will transmit valve "hiss" into car.

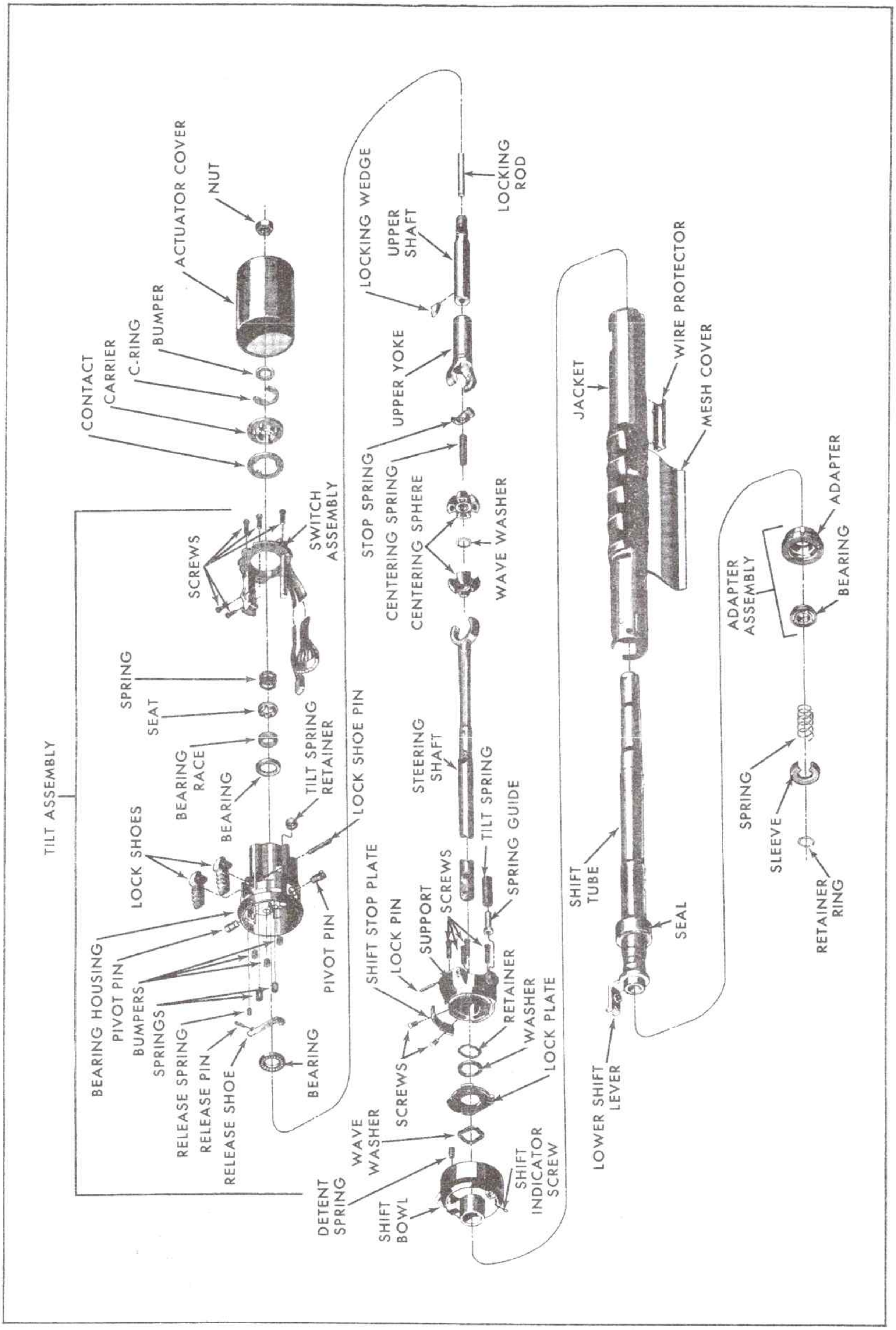


Fig. 9-48 Tilt and Telescope Steering Column Disassembled

23. Correcting Excessive Rotational Lash on Tilt and Telescoping Wheel (On Car)

Excessive rotational lash in the tilt column spherical joint results in a loose steering feel, a "chucking" noise, or rattle from the tilt head area while driving over certain road surfaces.

The excessive lash can be corrected by installing special shims between the centering sphere halves.

The shims, resembling cross section of centering sphere, are available from servicing Parts Warehouses in a kit. This kit includes one .005 inch shim and two .010 inch shims for spacing between spherical halves from .005 inch to .025 inch.

One or more shims may be used as required, depending on the amount of lash. See Note 24 when installing shims to correct excessive rotational lash.

24. Tilt and Telescope Column (Fig. 9-48)

NOTE: Extreme care must be taken when working on the column as certain parts of the assembly are fragile and can be damaged if not handled carefully.

a. Disassembly

1. Remove steering column as described in Note 18a.

2. Position steering column in Holding Fixture, J-22573, Fig. 9-42.

3. Remove steering wheel as described in Note 17a.

4. Remove wire clip and protector.

5. Remove tilt release lever and signal switch lever.

6. Remove cap from hazard warning switch knob.

7. Push in on hazard warning knob and remove screw and knob.

8. Remove actuator cover using Actuator Cover Remover, J-22598, and Slide Hammer, J-6125, Fig. 9-49. Carefully drive outward with slide hammer to remove cover.

9. Position horn contact carrier assembly so that C-ring flat faces horizontal. Remove C-ring using Carrier and Spring Compressor, J-22191, making certain that half-socket shaped portion of tool contacts inner shoulder of horn contact carrier assembly and allows access to C-ring, Fig. 9-50. Steady tool with hand and turn screw just enough to free C-ring and remove C-ring.

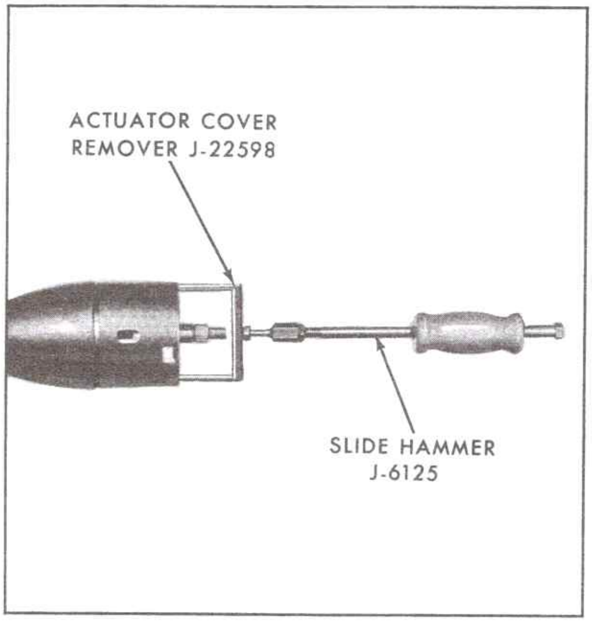


Fig. 9-49 Removing Actuator Cover

10. Remove Carrier and Spring Compressor, J-22191.

11. Remove horn contact carrier assembly.

12. Remove upper bearing spring.

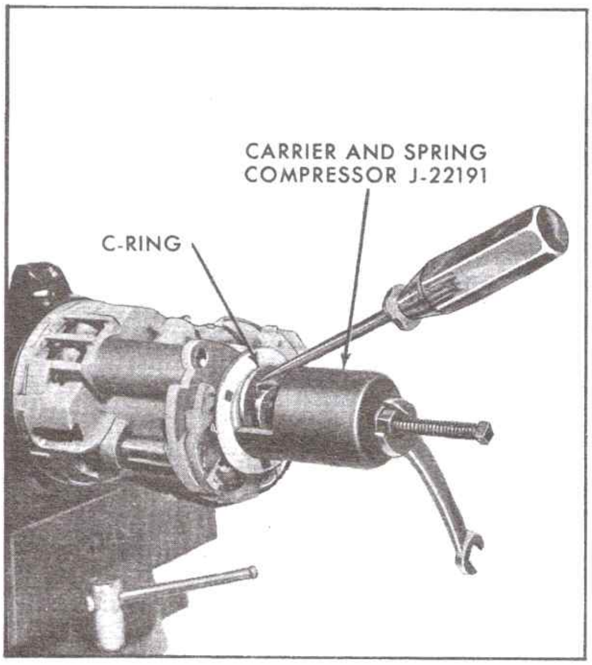


Fig. 9-50 Removing and Installing C-Ring

13. Remove signal switch and hazard warning switch screws.

14. Lift signal switch off bearing housing. Allow switches to hang by wires for later removal.

15. Install release lever and place column in full UP position. Using a large screwdriver, engage screwdriver in slot in tilt spring retainer and, pushing inward, turn retainer 1/8 turn counterclockwise until ears on retainer line up with grooves in housing and remove retainer.

16. Remove tilt spring and guide from housing.

17. Remove two pivot pins from support assembly using Pivot Pin Adapter, J-21854, along with Screw, J-21179-5, nut and washer. Thread nut on special hardened step screw, insert flat washer, and insert screw through flat end of Adapter. Thread bolt into tapped hole in pivot pin so open side of adapter faces shift bowl, Fig. 9-51. Make certain that hole in flat end of Remover Tool is centered over pivot pin. To pull pivot pin, hold bolt from rotating with one wrench while turning nut off screw with second wrench.

18. Lift tilt release lever and disengage lock shoes. Remove bearing housing. Allow bearing housing to hang with signal switches.

19. Gently push steering shaft sufficiently to remove retaining ring, washer, spring and plastic tolerance ring at the lower end of steering shaft.

20. Remove steering shaft from upper end of steering column.

21. Remove spring and stop spring by pushing stop spring from either side with a narrow bladed screwdriver. Spring will follow.

22. Hold hand over open end of upper shaft to prevent dropping locking rod when removing upper shaft. Turn upper shaft on a right angle to center line of lower shaft (90°), align flats on centering sphere with lower shaft coupling and remove upper shaft with sphere. Separate locking rod from upper shaft.

23. Hold yoke, shaft and sphere assembly with sphere up. Remove two-piece centering sphere from upper yoke by rotating sphere so flats align with yoke coupling, then remove sphere. Hold hand over upper yoke and rotate so it is in upright position. Separate upper shaft and locking wedge.

24. Remove four support screws and support assembly.

25. Remove shift tube retaining ring and thrust washer.

26. Remove lower bearing adapter from jacket by depressing plastic fingers one at a time and pulling out lower end.

27. Remove two screws and remove neutral-safety switch from jacket.

28. Install Shift Tube Remover, J-22551, with blade on tool in notch in shift tube beneath the bowl key and with sleeve of tool engaging upper end of shift tube with notch on sleeve in line with bowl key. Align shift tube so that lower shift lever will not bind in T slot at bottom of jacket and press shift tube out of shift bowl by turning nut on Shift Tube Remover, Fig. 9-52. Do not hammer on shift tube to remove it.

NOTE: If shift tube remover does not completely remove shift tube, remove hooked portion of tool and, using tool sleeve, tap shift tube out.

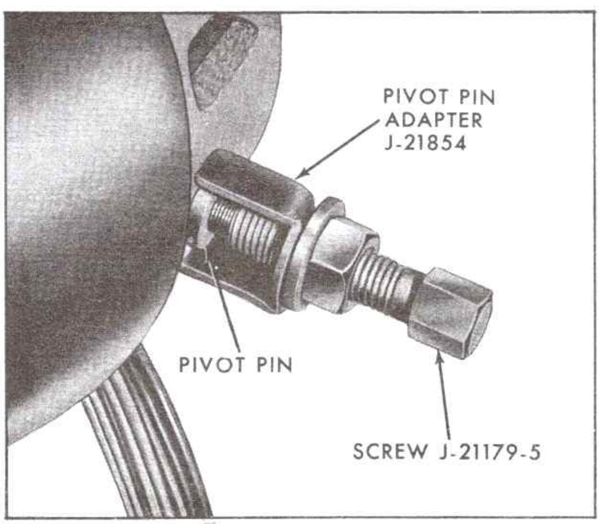


Fig. 9-51 Removing Pivot Pins

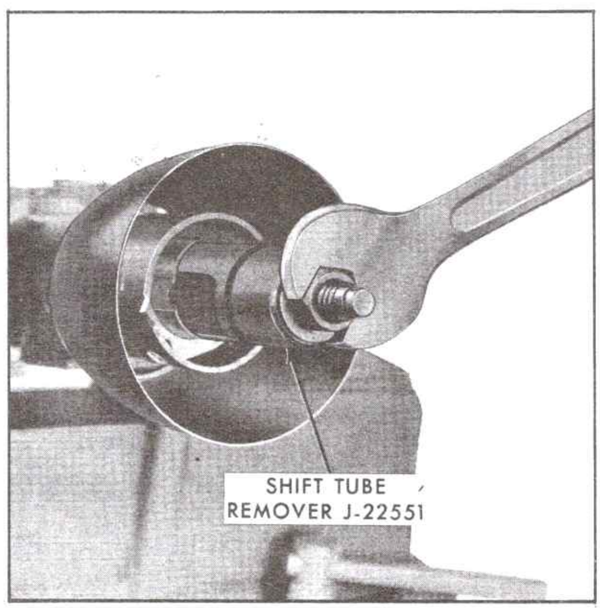


Fig. 9-52 Removing Shift Tube

CAUTION: Exercise extreme care in driving tube out if this procedure is necessary.

29. Remove shift tube from lower end of jacket.

30. Remove lock plate by sliding it out of jacket notches and tipping it down toward bowl hub at 12 o'clock position and under jacket opening.

31. Remove bowl from jacket. Remove signal switch and wires from bowl and bearing housing if not previously removed.

32. Support shift bowl and drive shift lever pivot pin from shift bowl and remove shift lever and wave washer.

33. If necessary, remove shift lever spring from bowl pocket by winding spring up with pliers and pulling out.

34. Wedge shoes inward with a block between the top of the shoes and the bearing housing and, using Pin Remover, J-22635, through slot in opposite side of housing, with flat on tool over shoulder next to pin drive release lever pin out of bearing housing, Fig. 9-53. Remove Pin Remover, J-22635, and remove release lever and spring.

35. Using Pin Remover, J-22635, drive out lock shoe pin. Carefully remove Pin Remover and remove lock shoes and springs.

36. Mesh cover may be removed from jacket by running the back of a knife blade between the overlap of fabric and then unwrapping the cover.

b. Inspection

1. Inspect all bearings for wear, roughness, and binding. Replace as required.

2. Inspect centering sphere for nicks, damage, and wear. If damage is evident, check shaft couplings for nicks, burrs, and rough spots.

3. Inspect bearing surfaces of upper shaft for brinelling nicks, scratches and wear.

4. Inspect rubber bumpers, making certain they are not torn or damaged.

5. Inspect telescoping mechanism for wear in key way.

6. Inspect all threads and splines for damage.

7. Inspect locking rod for straightness.

8. Inspect shift bowl for cracks.

9. Inspect steering shaft, shift tube and jacket for signs of damage. Pay particular attention to mesh area of jacket and plastic joints in shift tube and steering shaft.

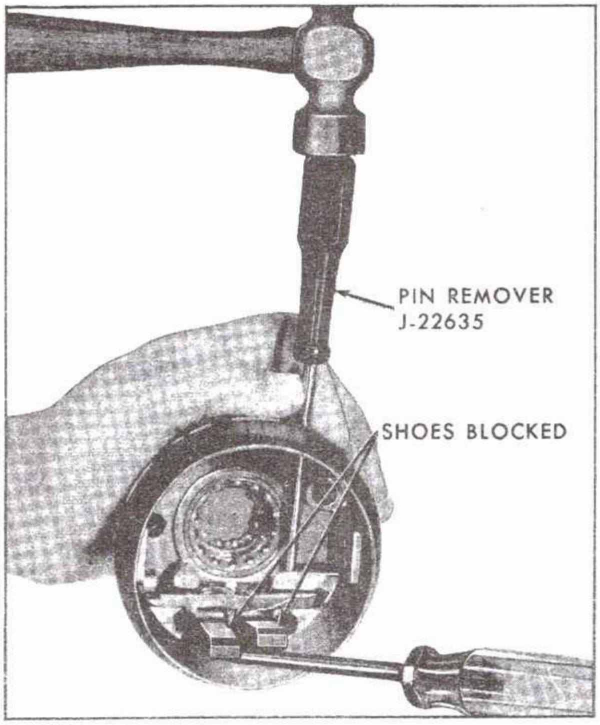


Fig. 9-53 Removing Release Mechanism

10. Inspect all other parts for damage and wear. Replace if necessary.

c. Assembly

1. Apply a thin coat of lithium base (ball joint) grease to all friction surfaces.

2. If removed, wrap mesh cover around column and secure with electrical or friction tape.

3. Using Pin Remover, J-22635, to line up shoes, install lock shoe springs and lock shoes in bearing housing and retain with pin.

NOTE: With tilt lever opening in housing on left side, and shoes facing up, the four slot shoe is on the left.

4. Wedge shoes inward with a block between the top of the shoes and the bearing housing, install spring, release lever and pin in bearing housing. Remove block from shoes.

5. Install new shift lever spring in pocket of shift bowl if removed.

6. Support shift bowl and install shift lever and wave washer securing them with pin. Wave washer should be positioned on top of shift lever.

7. Install signal switch wire harness and connector through the bearing housing and shift bowl, Fig. 9-57.

8. Slide bowl into jacket.

10. Install wave washer and lock plate. Work lock plate into notches in jacket by tipping lock plate toward bowl hub at 12 o'clock position and under jacket opening. Slide lock plate into notches in jacket.

10. Carefully install shift tube in lower end of jacket. Align keyway in tube with key in bowl and lower shift lever with T slot in jacket.

11. Install Shift Tube Installer, J-22549, aligning flat on lower portion of tool with keyway in tube and insert tool into tube. Turn tool so that lower portion of tool catches under indented portion of shift tube at keyway. Keeping lower shift lever lined up with T slot, turn nut on top of J-22549, Fig. 9-54, until shift tube bottoms on bowl. Check to make sure that neutral-safety switch hole in shift tube lines up with slot in jacket and that lower shift lever has clearance in jacket. Do not push or tap on end of shift tube. Remove Shift Tube Installer.

12. Install thrust washer and retaining ring on shift tube, pulling shift bowl upward to compress wave washer. If retaining ring cannot be installed, adjust position of shift tube with Shift Tube Installer, J-22549.

13. Install support aligning V in support with V notch in jacket and secure with four screws. Tighten screws to 50 inch-pounds.

14. Align plastic fingers on lower bearing adapter with holes in jacket and install adapter. Shift tube should pilot in adapter.

15. Install neutral safety switch, securing it to jacket with two screws.

NOTE: Do not substitute screws or interference with shift tube may result.

16. Position locking wedge in upper steering shaft, Fig. 9-55, align with keyway and slide upper shaft into upper yoke from below.

17. Install sphere and wave washer removed during disassembly in upper yoke.

NOTE: If shims are being used to correct excessive rotational lash, wave washer must be discarded.

18. Rotate centering sphere so that lower steering shaft can be installed over flats on sphere (approximately 90° from center line of upper shaft). Then install lower shaft coupling over the sphere. Make sure that slash mark on end of upper shaft lines up with flat on splined end of lower shaft.

19. Turn upper shaft slightly from center line of lower shaft and insert one end of spring into lower shaft coupling. Place stop spring over spring. Using a narrow bladed screwdriver, compress spring with screwdriver and slide stop spring in so that it seats in upper yoke, Fig. 9-56.

20. Install steering shaft assembly in shift tube from upper end. Carefully guide shaft through shift tube, lower seal and bearing.

21. Install lower bearing spring, plastic tolerance ring and retaining ring on lower steering

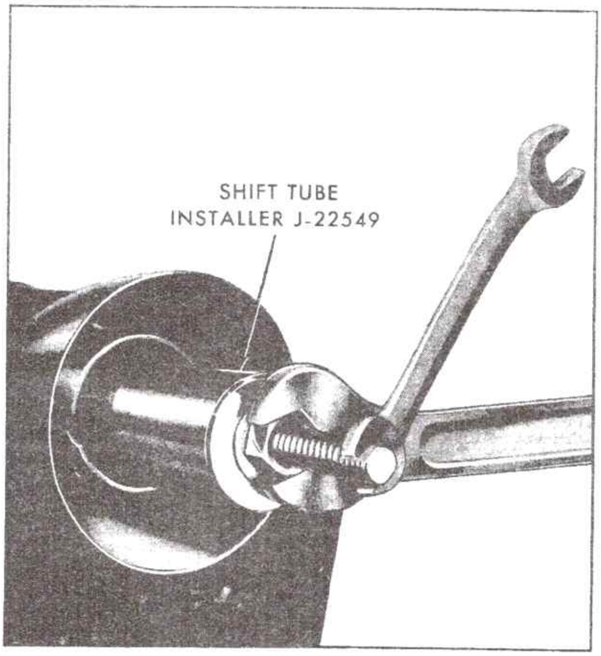


Fig. 9-54 Installing Shift Tube

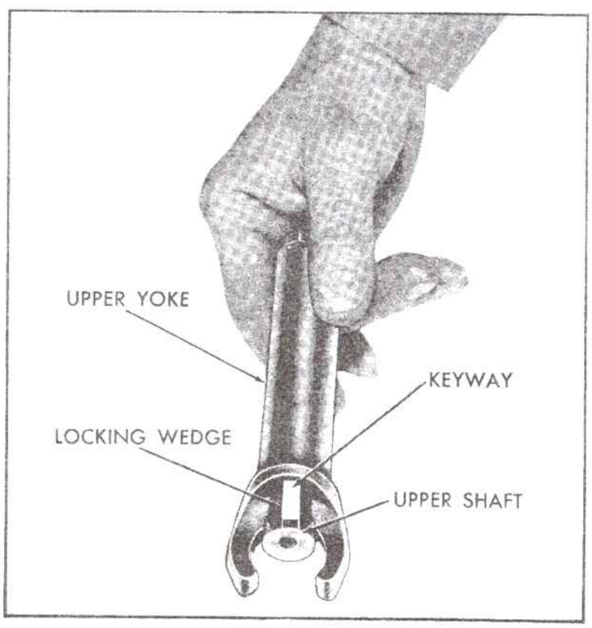


Fig. 9-55 Installing Locking Wedge and Upper Shaft Into Upper Yoke

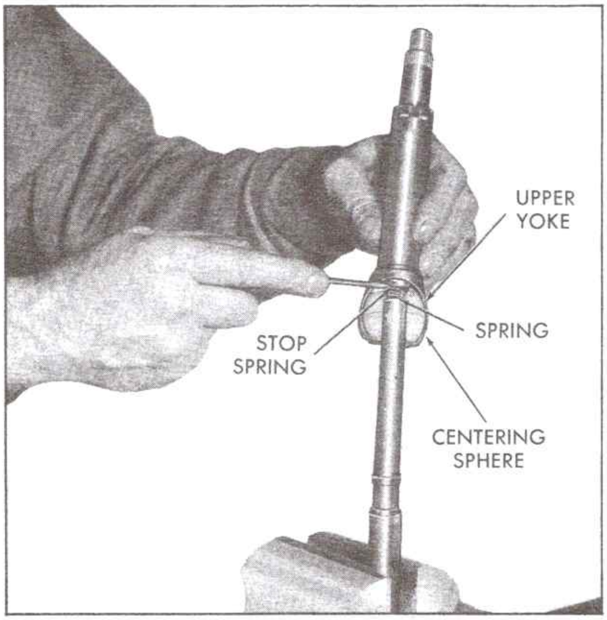


Fig. 9-56 Installing Spring and Stop Spring in Steering Shaft

shaft. If any of the following parts in the column have been replaced, replace the tolerance ring.

a. Steering shaft assembly.

b. Adapter assembly.

c. Jacket.

d. Support or bearing housing.

22. If tolerance ring is to be replaced, proceed as follows:

a. Install tolerance adjuster sleeves on steering shaft.

b. Turn inner sleeve until the outer adjuster is finger tight and there is no lash in steering shaft.

CAUTION: Do not overtighten or steering shaft will be damaged.

c. Back off inner sleeve 1/8 to 1/4 turn.

d. Using a hot iron fuse the sleeves together in three places equally spaced approximately 1/8 inch wide.

23. Install tilt release lever and, holding lock shoes in disengaged position, assemble bearing housing over steering shaft until pivot pin holes line up. Use care not to knock bearing balls out of bearing housing. Install inner bearing race and retainer.

24. Install pivot pins by tapping them in with a plastic mallet. The column must be supported to prevent any bending forces on the collapse area.

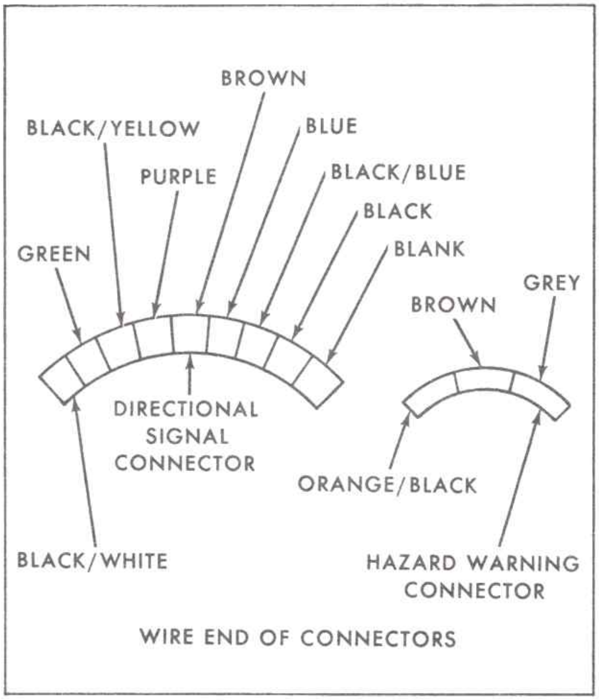


Fig. 9-57 Signal Wire Placement in Connector

25. Place housing in full UP position and install tilt spring, spring guide and retainer. Using a large screwdriver, engage slot in retainer, aligning ears on retainer with slot in housing, push retainer in and turn 1/8 turn clockwise to retain it.

26. Install signal switch and hazard warning switch and secure with five screws. Tighten screws to 35 inch-pounds.

27. Install bearing race and seat.

NOTE: When performing steps 28 through 30, location references are based upon keyway in upper yoke being the uppermost position.

28. Install upper bearing spring so that upper end of upper bearing spring is positioned to the left and within one-half inch of keyway on upper yoke.

29. Install horn contact carrier assembly over upper shaft so that snap ring tab seat on carrier is aligned with keyway in upper yoke.

30. Install Carrier and Spring Compressor, J-22191, on column so that half socket shaped portion of tool contacts inner shoulder of horn contact carrier assembly on left side. Turn screw just enough to allow installation of C-ring and install C-ring from right side so that it engages tab seat in horn contact carrier assembly, Fig. 9-50.

31. Remove Carrier and Spring Compressor, J-22191, from column.

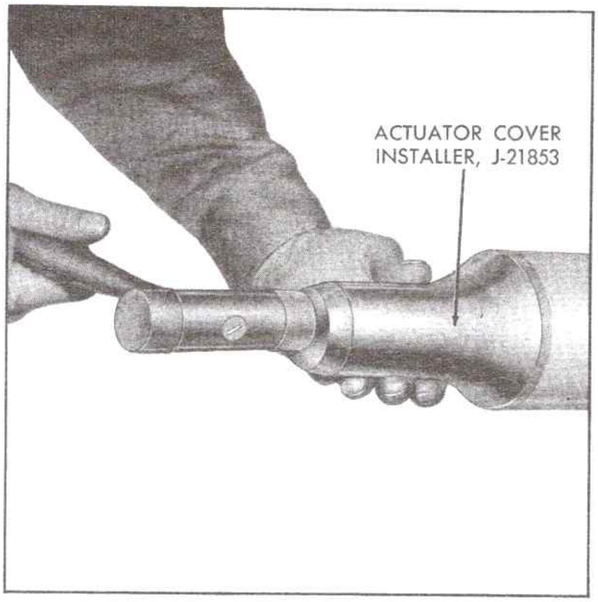


Fig. 9-58 Installing Actuator Cover

32. Remove tilt lever.

33. Position actuator cover on actuator housing so that key in cover is aligned with keyway in housing.

34. Install actuator cover on housing using Actuator Cover Installer, J-21853, Fig. 9-58. Support steering column in the bowl area so that it is not damaged when the cover is driven on. Tap lightly. Push hazard warning switch operating pin so that it will not be damaged by the cover.

35. Install tilt lever and turn signal lever through holes in actuator cover.

36. Install hazard warning knob with one screw. Tighten screw to 8 inch-pounds. Snap cap on switch.

37. Install steering wheel as described in Note 17b.

38. Install steering column as described in Note 18b.

TILT AND TELESCOPE WHEEL DIAGNOSIS CHART

Condition	Cause	Correction
Poor return of steering.	Steering shaft to jacket misalignment.	Center steering column assembly.
	Worn or damaged upper shaft bearings.	Replace actuator housing.
Steering wheel loose on shaft.	Jacket damaged at upper end.	Replace jacket.
	Steering wheel nut loose.	Tighten nut to 35 foot-pounds.
Tilt and Telescope wheel inoperative or slow to return to "up" position.	Tilt spring weak or broken.	Install new spring as necessary.
	Pivot pins binding or seized.	Install new pivot pins.
	Lock shoes seized.	Install new lock shoe spring.
		Lubricate lock shoe pivot pins.
		Install new actuator housing.
Outside air, dust, or engine noise being transmitted up steering column.	Mispositioned or worn seal.	Install new seat and seal in lower end of shift tube. Lubricate center of seal before installing.

TILT AND TELESCOPE WHEEL DIAGNOSIS CHART (Cont'd.)

Condition	Cause	Correction
Horn inoperative.	Leads disconnected at horn upper contact assembly.	Connect leads.
	Defective clip and spring assembly at turn signal housing assembly or defective horn wire.	Replace turn signal housing assembly.
	Horn wire not connected to chassis wiring harness.	Connect horn wire.
	Contact worn down.	Replace upper contact assembly.
Horn blows continuously.	Short in horn button switch assembly.	Replace button or contact assembly.
	Short in horn button switch assembly lead.	Repair lead or replace contact assembly.
	Contact plate or horn upper contact assembly shorts on reverse side of steering wheel hub because it is mispositioned or insulated portion is cracked.	Remove wheel and position upper contact assembly on hub. Replace upper contact assembly if insulated portion is cracked.
	Horn upper contact assembly mispositioned and shorts against wheel skirt.	Remove wheel and position on horn contact carrier assembly.
Horn blows when signal lever is moved.	Tang on turn signal housing assembly does not engage turn signal actuator shaft because pivot is mispositioned or tang is broken.	Remove actuator cover and engage. Replace turn signal housing assembly if tang is broken.
Turn signal does not operate properly or fails to cancel.	Defective turn signal switch.	Install new switch.
	Bent or broken detent spring in actuator yoke.	Install new spring.
	Damaged actuator yoke.	Replace yoke.
	Turn signal cancelling pins broken on horn contact carrier assembly.	Install new horn contact carrier assembly.
Insufficient release travel or rough operation of shift lever.	Broken, damaged, or improperly installed shift lever spring.	Install spring properly or install new spring.
Excessive shift lever effort.	Steering column mis-aligned.	Align steering column properly.

TILT AND TELESCOPE WHEEL DIAGNOSIS CHART (Cont'd.)

Condition	Cause	Correction
Excessive shift lever effort (Cont'd.)	Lack of lubricant or dirt at lower end of shift tube.	Clean and lubricate as necessary. Install new O-ring.
	Shift tube damaged or worn.	Install new shift tube.
	Jacket damaged.	Replace jacket.
Shift lever loose.	Wave washer mispositioned.	Remove lever and position wave washer.
	Lever pivot pin loose.	Install new pivot pin.
Shift tube "squawks" when shift lever is moved.	Lack of lubricant at lower end of shift tube.	Lubricate as necessary and install new O-ring.
Steering wheel loose in every other tilt position.	If loose at top, center and -10 degrees (two positions below center), right shoe is faulty. At remaining positions, left shoe is faulty.	Install new pivot pin and shoe on affected shoe.
Steering wheel fails to return freely to top tilt position.	Pivot pins are bound up.	Remove pivot pins and check holes for burrs.
	Wheel tilt spring is defective.	Remove spring and install new spring.
Noticeable rotational looseness in steering wheel especially on rough roads, causing thump or rattle.	Excessive lash in centering sphere.	Install centering sphere shims as required. Wave washer should not be used if shims are installed.
Locking lever fails to lock or unlock wheel.	Improper adjustment of flange and screw assembly.	Adjust flange and screw assembly and locking lever for proper adjustment.
	Locking rod too short or missing.	Install new locking rod.
	Flange and screw assembly too short.	Install new flange and screw assembly.
Loud noise when wheel is telescoped.	Bumpers cut or missing.	Replace bumpers.
Turn signal lever loose. No detent position.	Turn signal yoke and pivot shaft loose.	Replace turn signal housing assembly.

FLEETWOOD ELDORADO STEERING

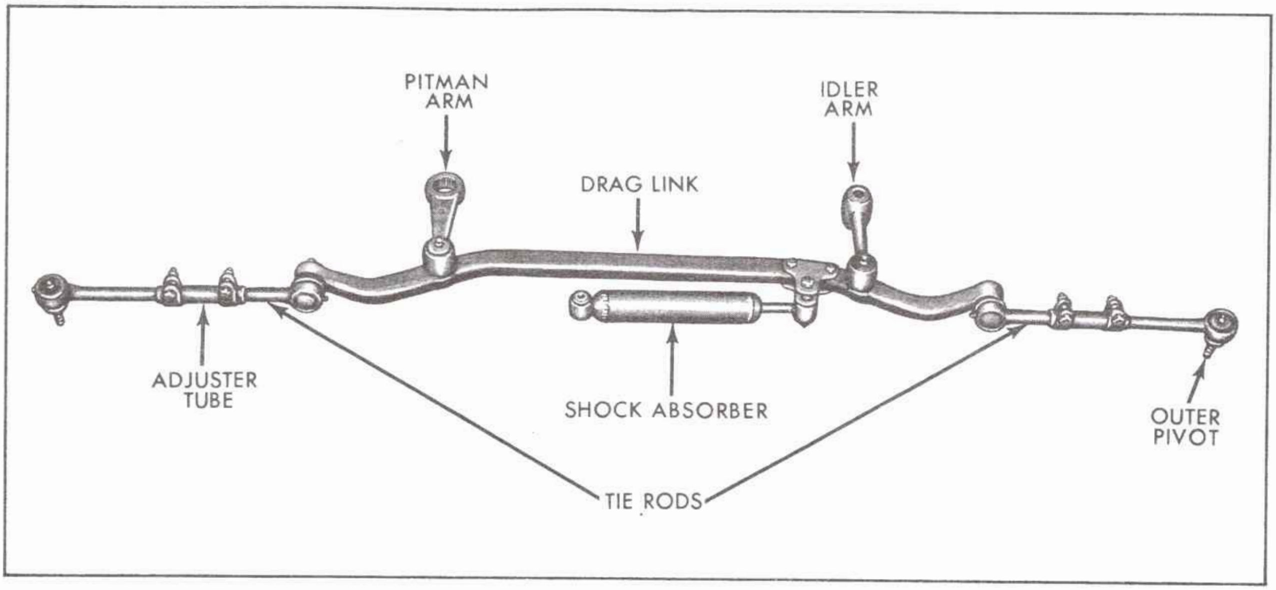


Fig. 9-59 Steering Linkage (693)

The service information that follows pertains only to the Fleetwood Eldorado. All other description, service procedures and recommendations for the Fleetwood Eldorado are the same as those for the standard car as given in the first part of this section.

Steering Linkage (693)

The steering linkage on the 693, Fig. 9-59, consists of a pitman arm, idler arm, two tie rod assemblies, a one piece forged steel drag link, and a shock absorber. The pitman arm connects the left side of the drag link to the steering gear and the idler arm connects the right side of the drag link to the frame. The shock absorber connects the drag link to the frame in such a manner as to dampen vibrations in the linkage. The tie rods serve as connecting links between the drag link and the steering arms. Tie rod ends should be checked for looseness and damaged seals. Loose tie rod ends must be replaced as a unit. Tie rod seals are replaceable and any damaged seals should be replaced.

25. Steering Gear (693)

a. Removal

1. Disconnect pressure and return lines hoses at rear of pump reservoir. Cap pump fittings to prevent drainage of fluid from pump. Also, cap or tape hose fittings. On cars equipped with a steering pump cooler, disconnect return hose at cooler.

2. Raise front end of car and place on jack stands.

3. Remove cotter pin and nut at pitman arm.

4. Disconnect pitman arm from drag link using Puller, J-22292.

5. Remove two bolts holding flexible coupling together.

6. Remove three screws that hold steering gear to frame side rail, move steering gear forward and downward out of car.

7. Working on bench remove pitman shaft nut and lock washer and remove pitman arm from pitman shaft using Pitman Arm Puller, J-9172.

b. Installation

1. Place pitman arm on pitman shaft and install lock washer and nut on pitman shaft. Tighten nut to 140 foot-pounds.

2. Position steering gear on car and secure to frame side rail with three screws and flat washers. Tighten screws to 60 foot-pounds.

3. Install bolts that hold flexible coupling together. Tighten bolts to 18 foot-pounds.

4. Install drag link to pitman arm and secure with nut and cotter pin. Tighten nut to 40 foot-pounds before installing cotter pin.

5. Connect pressure and return hoses at pump or oil cooler. Tighten all threaded fittings to 25 foot-pounds.

6. Check fluid level and bleed hydraulic system as described in Note 1.

26. Lower Steering Shaft (Fig. 9-60)

a. Removal

1. Remove two bolts holding flexible coupling together.

2. Remove screw holding flexible coupling to steering gear and shift portion of flexible coupling on gear away from flange on shaft.

3. Disengage flange on shaft from flexible coupling.

4. Remove screw securing universal joint to steering shaft.

5. Remove lower steering shaft from steering column.

6. Remove flexible coupling from steering gear.

7. Remove screw securing universal joint to shaft and remove universal from shaft.

b. Installation

1. Position universal joint on lower shaft with flat of shaft in line with split in joint. Secure with screw tightening it to 60 foot-pounds.

2. Position flexible coupling on steering gear with large pin on coupling at top.

3. Install shaft assembly on car with universal joint engaging steering column shaft. Align split in universal joint with flat on steering column shaft.

4. Engage flexible coupling with flange on shaft and install two bolts that hold coupling together. Tighten bolts to 18 foot-pounds.

5. Secure universal joint to steering column with one screw. Tighten screw to 60 foot-pounds.

6. Secure flexible coupling to steering gear with screw. Tighten screw to 18 foot-pounds.

27. Steering Linkage Removal, Disassembly, Assembly, and Installation (693 Only)

a. Removal

1. Remove front wheels.

2. Remove cotter pins and nuts from outer tie rod pivots at steering arms.

3. Remove tie rod pivots from steering arms using Tie Rod End Puller, J-21930.

4. Remove bolt securing shock absorber to bracket on frame.

5. Remove cotter pins and nuts from pitman arm and idler arm pivots on drag link.

6. Remove idler and pitman arm pivots from drag link using Puller, J-22292.

7. Remove linkage from car.

8. Remove bolt and lock nut securing idler arm to frame and remove idler arm from car.

b. Disassembly

1. Remove cotter pins and nuts from inner tie rod pivots.

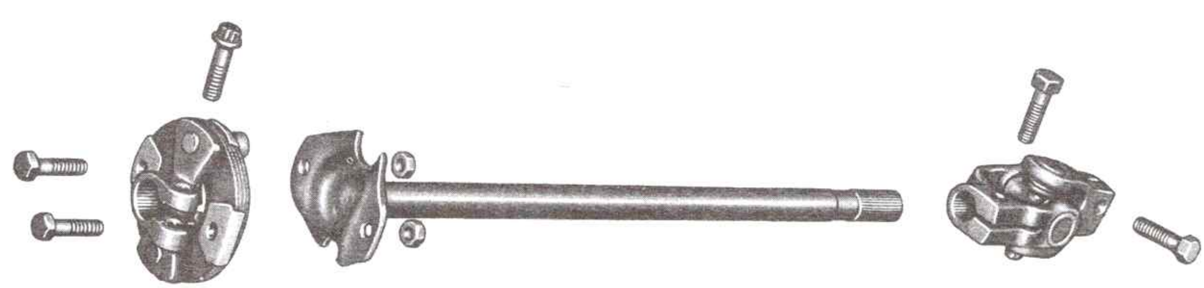


Fig. 9-60 Lower Steering Shaft (693)

2. Remove tie rods using Tie Rod End Puller, J-21930.

3. Remove tie rod outer pivots by loosening nuts on outer clamp bolts and unscrewing tie rod outer pivots from adjuster tube.

4. Loosen nuts on inner clamp bolts and unscrew tie rod inner pivots from adjuster tubes.

5. Remove bolts securing shock absorber to brackets on drag link and remove shock absorber and spacer.

c. Assembly

1. Position shock absorber and spacer to brackets on drag link. Spacer should be positioned between shock absorber attachment and upper part of bracket.

2. Attach shock absorber to bracket with bolt and tighten all bracket bolts to 15 foot-pounds.

3. Lubricate adjuster tube with chassis lubricant, install adjuster tubes and clamps on tie rod inner pivots.

4. Thread tie rod outer pivots into adjuster tubes.

NOTE: An equal amount of thread should be exposed on both ends of the adjuster tubes.

5. Install both tie rods on drag link, tighten nuts to 40 foot-pounds and install cotter pins.

d. Installation

1. Install idler arm on frame with bolt and lock nut. Tighten bolt to 95 foot-pounds.

2. Install drag link on pitman arm and idler arm pivots and tighten pivot nuts to 40 foot-pounds. Install cotter pins.

3. Install tie rod outer pivots to steering knuckles and tighten nuts to 40 foot-pounds. Install cotter pins.

4. Install shock absorber to frame bracket, tighten bolt to 15 foot-pounds.

5. Install front wheels on car.

6. Adjust alignment as described in Section 3, Note 33.

28. Tie Rod End Seal Replacement

1. Raise front of car and place on jack stands.

2. If replacing outer tie rod end seal, remove front wheel.

3. Remove cotter pin and nut from tie rod pivot.

4. Remove tie rod end pivot from steering arm using Tie Rod End Puller, J-21930, on outer ends or from drag link using Puller, J-22292, on inner ends.

5. Pry old seal off tie rod pivot.

6. Wipe tie rod end pivot clean.

7. Position new seal on tie rod pivot. Using Seal Installer, J-21150-1, drive flange of seal over seat on pivot.

8. Position tie rod end to steering arm or drag link and install nut. Tighten nut to 40 foot-pounds.

9. Secure pivot nut with cotter pin.

10. Remove service plug from tie rod pivot.

11. Using Spherical Joint Repacking Gun, J-9280, repack tie rod end until grease is expelled at lip of seal.

12. Install service plug in tie rod pivot.

13. If outer pivot seals were replaced, install front wheel.

14. Remove jack stands and lower car.

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot-Pounds
280M	Mounting Bracket to Pump Screw	3/8 - 16	23
Special	Pump Pressure Unions	5/8 - 18	30
286M	Pump Pulley Nut	1/2 - 20	45
260M	Pump Mounting Bracket to Engine Screw	3/8 - 16	23
260M	Flexible Coupling Upper Clamp Screw	3/8 - 24	30
280M	Flexible Coupling Lower Clamp Screw	3/8 - 24	30
286M	Flexible Coupling Nut (693)	5/16 - 24	18
286M	Flexible Coupling Nut (693)	3/8 - 24	18
300M	Universal Joint Clamp Bolt (693)	7/16 - 20	60
Special	Rack-Piston End Plug	1-5/16 - 16	75
Special	Rack-Piston Ball Guide Clamp Screw	1/4 - 20	12
280M	Steering Gear Side Cover Screws	3/8 - 16	35
300M	Steering Gear to Frame Screw	7/16 - 14	60
Special	Steering Gear Adjuster Lock Nut	7/16 - 20	30
Special	Pitman Shaft Nut	7/8 - 14	140
Special	Pitman Arm to Drag Link Nut	1/2 - 20	40
Special	Idler Arm to Drag Link Nut	1/2 - 20	40
Special	Inner Tie Rod Pivot to Drag Link Nut	1/2 - 20	40
280M	Idler Arm to Frame Screw	3/8 - 24	35
Special	Tie Rod Adjuster Clamp Nut	3/8 - 24	20
Special	Tie Rod Pivot to Steering Arm Nut	1/2 - 20	40
Special	Upper Clamp to Steering Column Screw	5/16 - 18	30
Special	Lower Clamp to Steering Column Screw	5/16 - 18	30
Special	Lower Clamp to Cowl Screw	5/16 - 18	30
Special	Upper Clamp to Dash Panel Screw	5/16 - 18	30
301M	Steering Wheel Nut (Standard Wheel)	1/2 - 20	35
286M	Steering Wheel Nut (Tilt and Telescope Wheel)	9/16 - 18	35
280M	Idler Arm to Frame Bolt (693)	5/8 - 11	95
280M	Shock Absorber to Frame or Bracket Bolts (693)	7/16 - 14	15
300M	Shock Absorber Bracket to Drag Link Bolt (693)	5/16 - 18	15
			Inch-Pounds
6010M	Turn Signal Lever Screw	#8-32	30
1010-1020	Hazard Warning Knob Screw	#6-32	8
Special	Tilt and Telescope Support Screws	#12-28	50

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and classification.

SPECIAL TOOLS

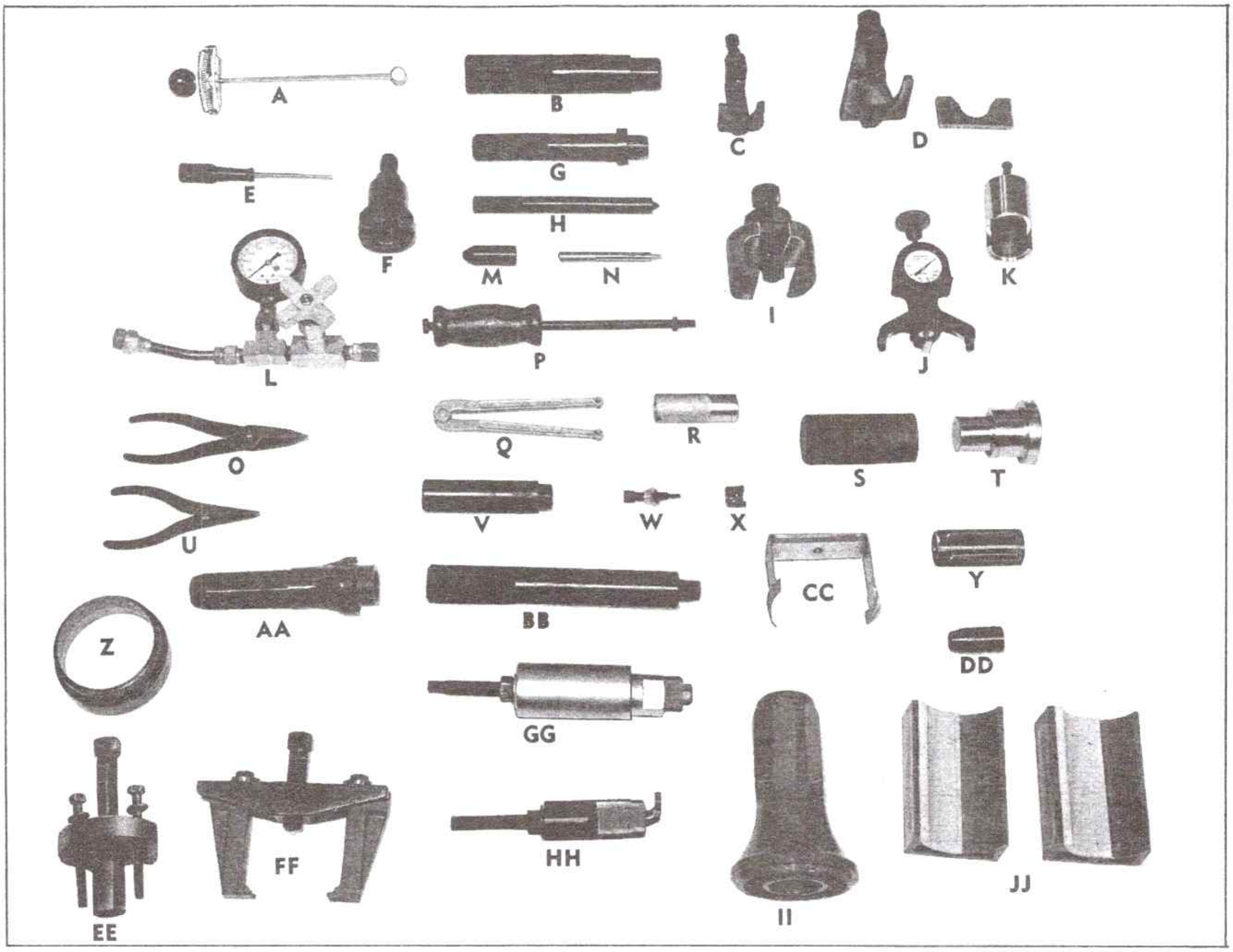


Fig. 9-61 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-7754	Torque Wrench (0-25 inch pounds)	T	J-22407	Pitman Shaft Bearing Installer
B	J-6657	Pitman Shaft Bearing Remover	U	J-4245	Snap Ring Pliers
C	J-21930	Tie Rod End Puller	V	J-6221	Adjuster Plug Bearing Remover and Installer
D	J-22292	Tie Rod End Puller			
E*	J-22635	Pin Remover	W*	J-21179-5	Hardened Step Screw
F	J-21883	Pump Pulley Puller	X*	J-21854	Pivot Pin Adapter
G	J-5188	Adjuster Plug Seal Installer	Y	J-7728	Pump Shaft Oil Seal Installer
H	J-7539	Rack-Piston Arbor	Z	J-7576	Rack-Piston Seal Protector
I	J-9172	Pitman Arm Puller	AA	J-22572	Bearing Installer
J	J-7316	Belt Tension Gage	BB	J-8092	Universal Handle
K*	J-22191	Carrier and Spring Compressor	CC*	J-22598	Actuator Cover Remover
L	J-5176-01	Pressure Testing Gage Assembly	DD	J-6222	Adjuster Plug Seal Protector
M	J-22616	Pump Shaft Oil Seal Protector	EE	J-1859-02	Steering Wheel Puller
N	J-6217	Valve Connector Seat Installer	FF	J-8990	Steering Linkage Puller
O	J-4880	Snap Ring Pliers	GG*	J-22549	Shift Tube Installer
P*	J-2625	Slide Hammer	HH*	J-22551	Shift Tube Remover
Q	J-7624	Spanner Wrench	II*	J-21853	Actuator Cover Installer
R	J-22569	Snap Ring Remover	JJ	J-22573	Steering Column Holding Fixture
S	J-6219	Pitman Shaft Seal Installer			

*Denotes Tilt and Telescope column only.

GENERAL DESCRIPTION

Wheels

Welded steel wheels are used on all 1967 Cadillac cars, 15 inches in diameter, with 6 inch flange type rims.

The wheel bolt circle diameter is 5 inches, the hub bore diameter, 3.0685 inches maximum. Five-1/2 inch diameter studs are used to mount the wheel. All wheel mounting studs have right hand threads. On all body styles except the Fleetwood Eldorado, the spider section of the wheel is reversed to accommodate deep formed wheel discs. The Eldorado wheel is deep dished with a distinctive design.

Wheels used on the Fleetwood Seventy-Five Sedan, and Limousine, and Commercial Chassis are the same as those used on all 1967 Cadillac cars except the Fleetwood Eldorado. However, they are riveted together and are of heavier stock thickness.

Tires

Black sidewall tires are provided as standard equipment on all 1967 Cadillac cars. White sidewall tires are optional.

Tires on the Fleetwood Eldorado must be mounted and de-mounted with the inner side of the wheel facing upward on the wheel mounting stand, due to the deep dish design of the wheel. Special adapters for tire mounting equipment may be required to perform this work.

SERVICE INFORMATION

1. Emergency Wheel Changing

a. Removal

CAUTION: On cars equipped with a Controlled Differential, do not jack one rear wheel off ground with engine running.

1. If at all possible, park car on level ground, off the highway.

2. Place transmission lever in PARK position and set parking brake.

3. Remove jack components and spare tire from luggage compartment (Fig. 10-1 standard cars and Fig. 10-2 Fleetwood Eldorado).

4. Install rack bar in jack base.

5. Block the wheel diagonally opposite the wheel to be removed.

6. When lifting front end of standard car, position jack as shown in Fig. 10-3. Engage cross-member at siderail with jack hook. When lifting rear end of standard car, engage jack hook in hole in frame.

a. When lifting front or rear end of Fleetwood Eldorado, position jack as shown in Fig. 10-4. Engage tab at bumper seam with hole in jack hook.

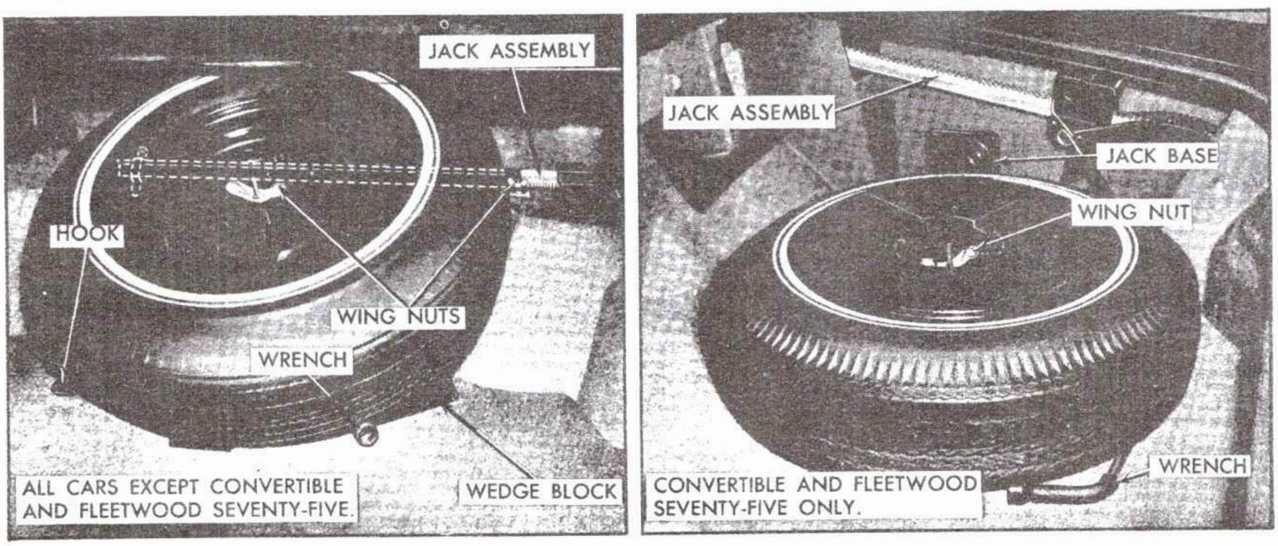


Fig. 10-1 Spare Tire and Jack Components (Except 693)

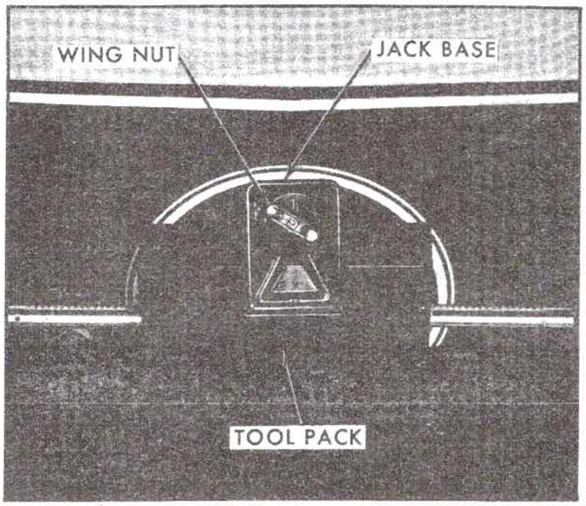


Fig. 10-2 Spare Tire and Jack Components (693 Only)

7. Raise jack until snug and reposition base so that rack bar is approximately vertical. (On slopes, shift the jack base in the downhill direction until the rack bar is positioned vertically or pointing slightly uphill.)

8. Use tip of jack handle to remove wheel disc. Rear wheel opening covers on cars so equipped, are removed by turning the locking rod tab located on the center lower edge of the covers. Place jack handle on locking rod tab (handle pointing rearward on left side or forward on right side). Then rotate handle outward to loosen locking rod. Tip cover outward at the top while raising up and away from the mounting hooks.

9. Loosen wheel nuts 1/2 turn counterclockwise.

10. Jack car until tire is off ground, remove wheel mounting nuts, and lift wheel off hub.

b. Installation

1. Place wheel on hub and tighten wheel mounting nuts finger tight.

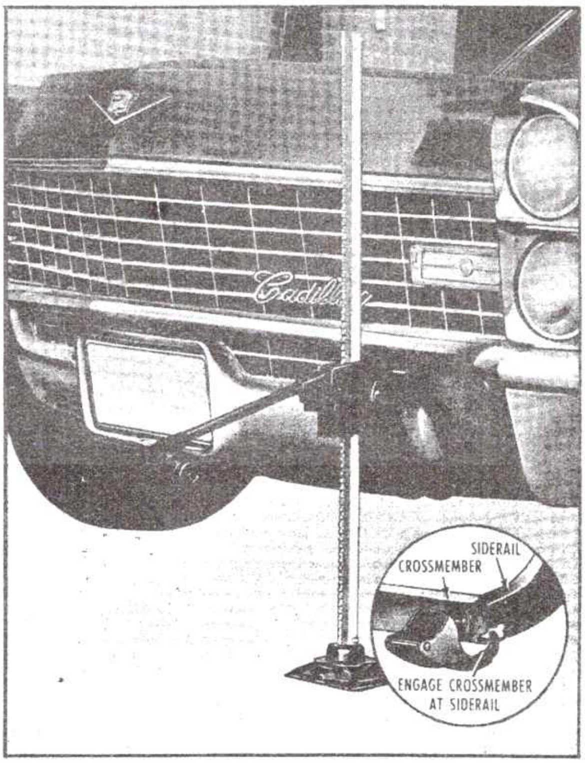
2. Lower car and remove jack.

3. Tighten wheel mounting nuts securely with jack handle.

4. Use rubber covered portion of jack handle to install wheel disc.

5. Standard car only - If rear wheelshield was removed, tip shield outward at the top while pushing down and inward toward the mounting hooks. Place jack handle on locking rod tab (handle pointing forward on left side or rearward on right side), then rotate handle outward to tighten locking rod.

NOTE: Jacking instructions for commercial vehicles are printed on the jack storage box. Wheel changing instructions, as previously described, also apply to commercial vehicles.



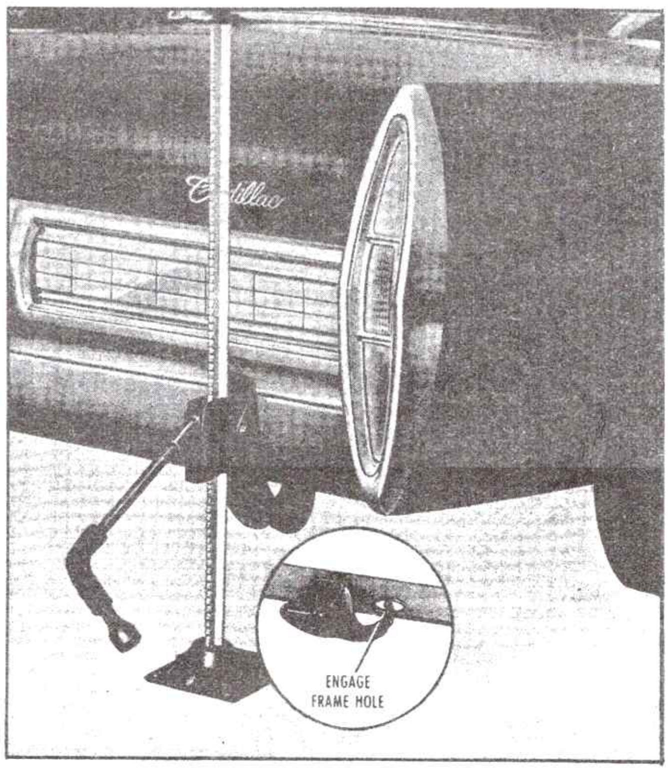


Fig. 10-3 Jack Position - Front and Rear Bumper (Except 693)

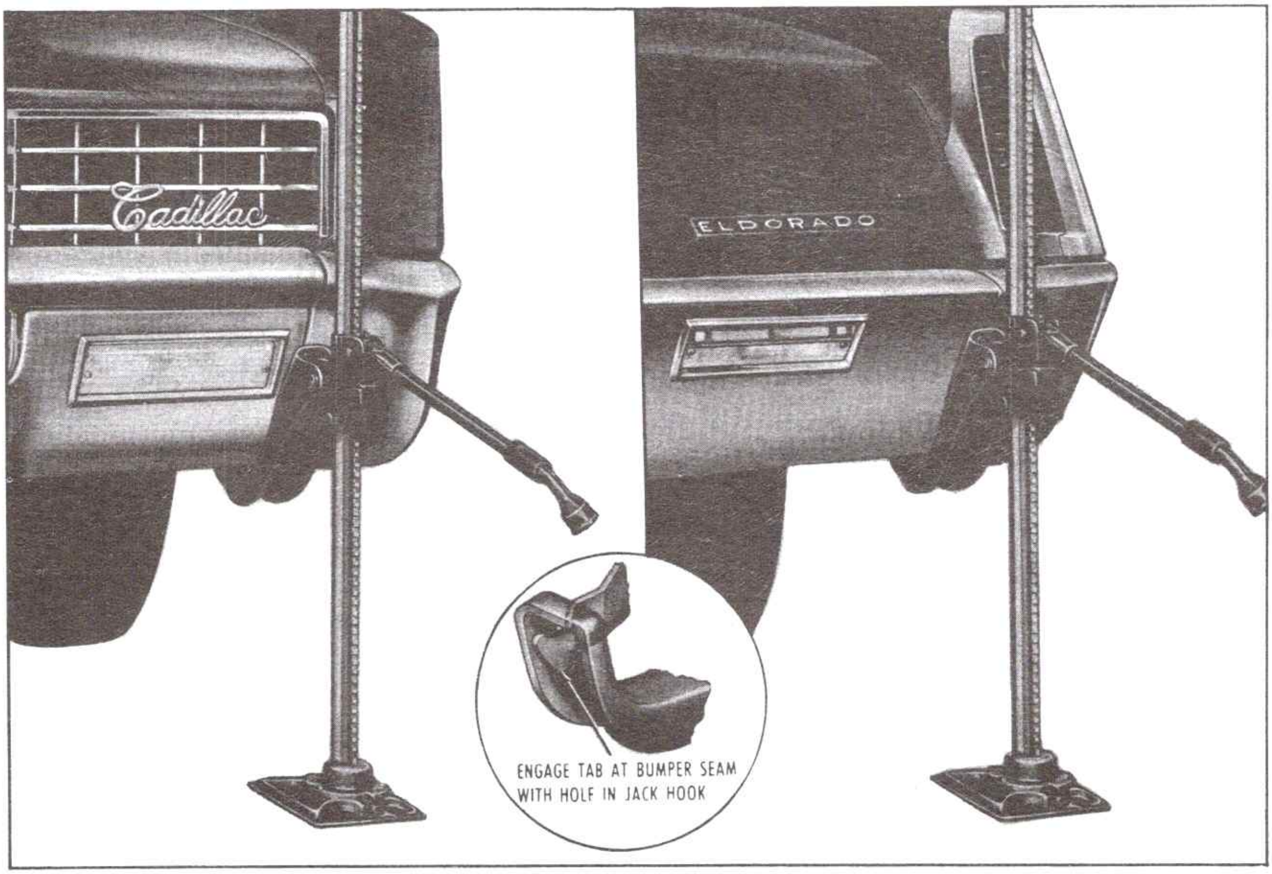


Fig. 10-4 Jack Position - Front and Rear Bumper (693 Only)

2. Tires

a. Tire Pressure

Tire pressures indicated in the Tire Data Chart are for tires at a stabilized temperature of 72°F. It takes approximately three hours exposure (out of sun) before tire pressure has stabilized, as it takes this long for temperature of air inside tire to equalize with temperature of air outside tire.

Recommended tire pressures and ply ratings for the various size tires used on 1967 Cadillac cars are listed in Fig. 10-5.

All tires, including the spare, should be checked at least once a month, and proper tire pressures should be maintained. Tire pressure should always be checked when tires are cold, never after a high speed trip. Heat developed from fast driving or from hot pavement increases pressure, which decreases again when tires cool.

After checking tires, the valve stem caps should be reinstalled. These caps are essential in keeping dirt out of the valves and in reducing the possibility of slow leaks.

Overinflation reduces the deflection from normal and causes the tire to wear in the center of the tread. Inflation pressures lower than those recommended will result in abnormal deflection of the tire and cause the tread in the shoulder area to wipe and scuff on the road.

b. Tire Rotation

It is recommended that tires be rotated every 6,000 miles on all 1967 Cadillacs. If abnormal tire wear should occur, the condition causing the problem should be determined immediately and corrected. Tire rotation may be a part of this correction. When necessary, tires should be rotated according to the pattern shown in Fig. 10-6.

c. Tire Noise Complaints

Complaints of axle noise are frequently caused by tires rather than by differential gears or bearings.

To determine whether tires are causing the noise, drive the car at various speeds and note the effect of part throttle, sudden acceleration, and deceleration on noise level. Axle and exhaust noise show definite variations under these conditions, while tire noise will remain constant.

Tire noise may be further checked by driving the car over smooth pavement with the tires at

TIRE USAGE AND INFLATION PRESSURE TABLE
Pounds per square inch (cool)

Series and Tire Size	Standard Inflation Pressure for All Loads Including Full Rated Loads
 9.00 x 15 *(4-Ply Rating 2-Ply)* Calais and De Ville Fleetwood Sixty Special & Brougham	1 to 6 passengers plus 200 lb. trunk load *(1100 lb. load)* **Front 24, Rear 24 p.s.i.** **Front 25, Rear 25 p.s.i.**
 8.20 x 15 *(8-Ply Rating 4-Ply)* Fleetwood Seventy-Five	1 to 9 passengers plus 200 lb. trunk load *(1550 lb. load)* **Front 28, Rear 38 p.s.i.**
	Optional Inflation for Reduced Loads: 1 to 5 passengers (750 lb. load) Front 28, Rear 28 p.s.i.
 9.00 x 15 *(4-Ply Rating 2-Ply)* Fleetwood Eldorado	1 to 6 passengers plus 200 lb. trunk load *(1100 lb. load)* **Front 24, Rear 22 p.s.i.**
 8.90 x 15 *(8-Ply Rating 6-Ply)* Commercial Vehicle	up to and including 7200 lb. Gross Vehicle Weight **Front 24, Rear 40 p.s.i.**
	Optional Inflation for Reduced Loads (6400 lb. Gross Vehicle Weight) Front 24, Rear 32 p.s.i.

- Tire Inflation pressures may increase as much as 6 pounds per square inch (p.s.i.) when tires are hot.
- For continuous high speed operation (over 75 mph) increase tire inflation pressures 4 pounds per square inch over the recommended pressures up to a maximum of 32 pounds per square inch-cool for 4 ply rating tires or 40 pounds per square inch-cool for 8 ply rating tires. Speeds above 75 mph are not recommended when the 4 pounds per square inch adjustment would require pressures greater than the maximum stated above.
- Cool tire inflation pressure: after vehicle has been inoperative for 3 hours or more, or driven less than 1 mile. Hot tire inflation pressure: after vehicle has been driven 10 miles or more at 60-70 miles per hour.
- Vehicles with luggage racks do not have a vehicle load limit greater than specified in the tire inflation pressure table.
- When towing trailers, the allowable passenger and cargo load must be reduced by an amount equal to the trailer tongue load on the trailer hitch.

Fig. 10-5 Tire Inflation Pressures

normal pressure and again over the same stretch of road when the tires have been inflated to 50 pounds pressure. If the noise for which the test is being made is caused by tires, it will be noticeably decreased when the tire pressure is increased, whereas rear axle or bearing noise should show no change in volume.

Thump is a noise caused when the tire moves over irregularities in the road or the irregularities of a tire moving over a smooth road. It is a periodic vibration which may be heard with varying degrees of loudness inside the car.

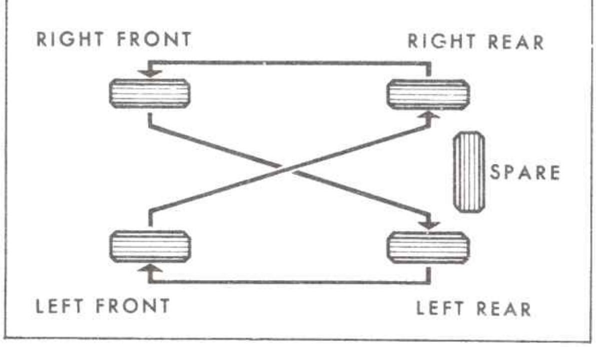


Fig. 10-6 Tire Rotation

A noisy or thumping tire usually may be singled out by inflating all tires to 50 pounds pressure and then driving the car. Deflate the tires, one at a time, to normal pressure. When the noise or thump appears, the tire just deflated is the faulty tire.

d. Tire and Wheel Runout and Eccentricity

Excessive radial or lateral runout of a wheel and tire together can cause tire roughness, tire wear, steering wheel tremor, and out of balance feel. To minimize these effects, tire and wheel runout should be checked and corrected as necessary. Proceed as follows:

When measuring runout on tires, check them as soon as possible after car has been driven, to avoid false readings due to the tendency of tires to take a temporary "set" after standing for a few hours. All runout measurements should be made on car.

Use Dial Indicator, J-8001, for measuring wheel runout. Provide a stand similar to the one shown in Fig. 10-7 for supporting the dial indicator. This stand was made with Dial Indicator Support, J-6126, and part of Clutch Piston Actuator Set, J-4353.

1. Raise wheel being checked.

CAUTION: When checking runout of rear wheels on cars equipped with a Controlled Differential, raise both rear wheels off the ground. Otherwise, the wheel in contact with the ground will prevent the opposite wheel from being rotated.

2. For checking total lateral runout at sidewall, position knob of Dial Indicator, J-8001, just above or below buffing rib on tire sidewall, Fig. 10-7. Set indicator at zero.

3. Rotate tire and wheel assembly, note and record amount of runout. Mark tire sidewall where minimum and maximum runout occurs. Maximum runout as measured on the tire should not exceed .050 inch.

4. For checking total radial runout at tread face, position knob of Dial Indicator, J-8001, in center of tread face, Fig. 10-8. Position knob so that it will be least affected by tread pattern. Set indicator at zero.

5. Rotate tire and wheel assembly, note and record amount of runout. Mark tire tread where minimum and maximum runout occurs. Maximum runout as measured on tire should not exceed .050 inch.

NOTE: If runout is excessive, but does not exceed .090 inch, it may be possible to reduce runout to an acceptable level by changing position of wheel on studs. Before rotating tire and wheel, original wheel location should be noted by marking one wheel stud and corresponding bolt hole with a daub of paint or chalk.

If runout cannot be reduced to an acceptable level by rotating tire and wheel around bolt circle, return tire and wheel assembly to original position on bolt circle, and check wheel runout only. Proceed as follows:

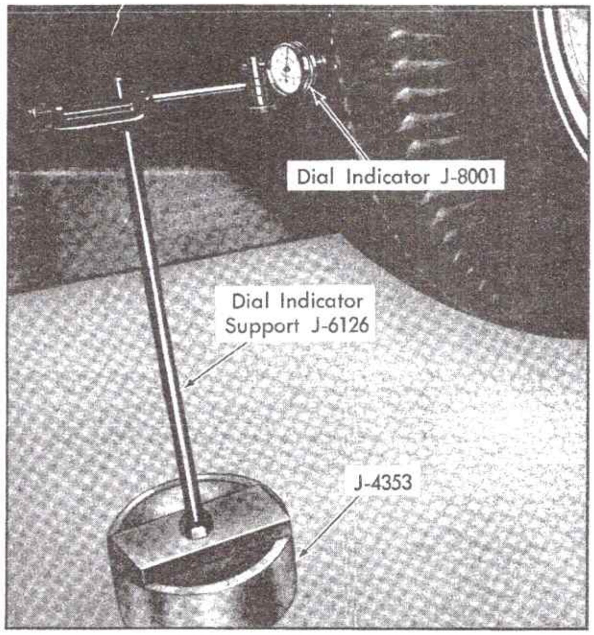


Fig. 10-8 Checking Radial Runout At Tread Face

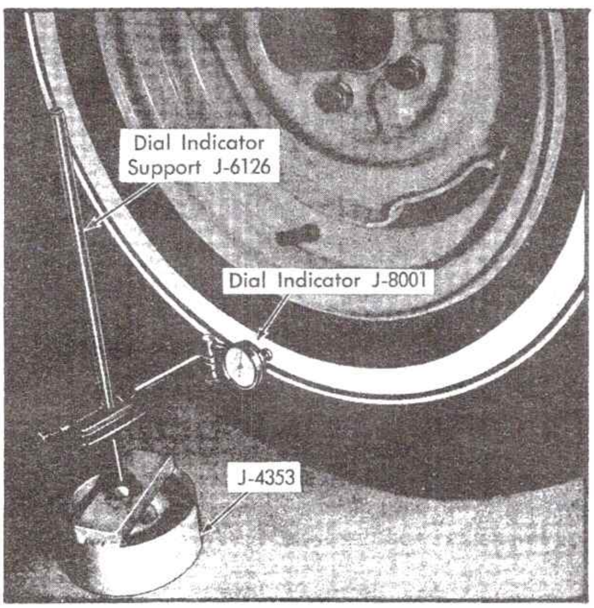


Fig. 10-7 Checking Lateral Runout At Sidewall

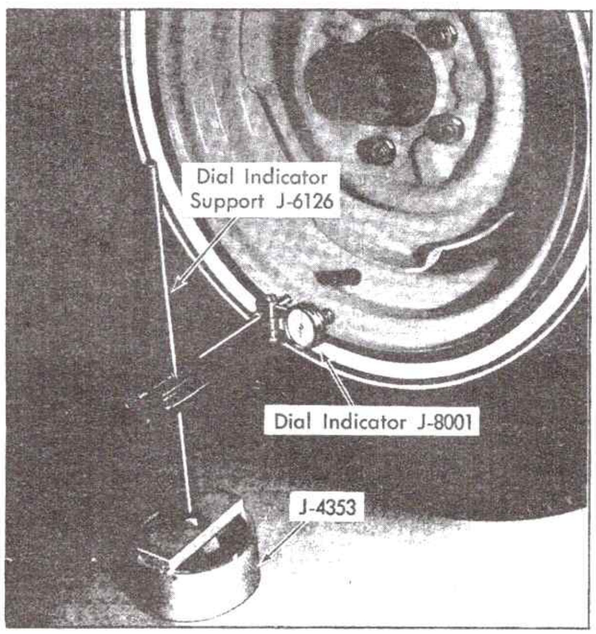


Fig. 10-9 Checking Lateral Runout At Bead Seat (Except 693)

6. Set indicator at zero, and with tire and wheel assembly raised, check lateral wheel runout at bead seat by positioning Dial Indicator Extension on vertical face of rim bead seat (felloe band) Fig. 10-9. Rotate tire and wheel assembly, note and record amount of runout. Mark rim where minimum and maximum runout occurs. Maximum runout as measured on rim bead seat should not exceed .045 inch.

7. Check radial wheel runout at bead seat by positioning Dial Indicator Extension on bottom face of rim bead seat (90° from felloe band) Fig. 10-10. Set indicator at zero. Rotate tire and wheel assembly, note and record amount or runout. Mark rim where minimum and maximum runout occurs. Maximum runout as measured on rim bead seat should not exceed .035 inch.

NOTE: When performing step 7 on the Fleetwood Eldorado it will be necessary to position the dial indicator on the inside of the wheel as shown in Fig. 10-11 due to the deep dish design of the wheel.

8. Rotate tire with respect to rim so that maximum runout point of tire, as marked on tire in steps 3 and 5 is at minimum runout point of the wheel, or vice versa. This correction should be performed for whichever condition (lateral or radial) is more severe.

NOTE: To rotate tire with respect to rim, it is necessary to remove tire and wheel assembly from car, deflate tire, break bond between bead seat and wheel, and then rotate tire as required.

9. Reinstall tire and wheel assembly on brake drum, aligning marked wheel stud and bolt hole.

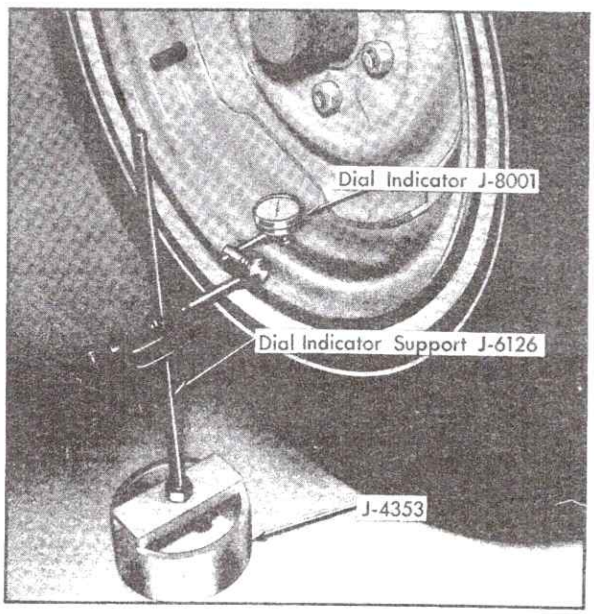


Fig. 10-10 Checking Radial Runout At Bead Seat (Except 693)

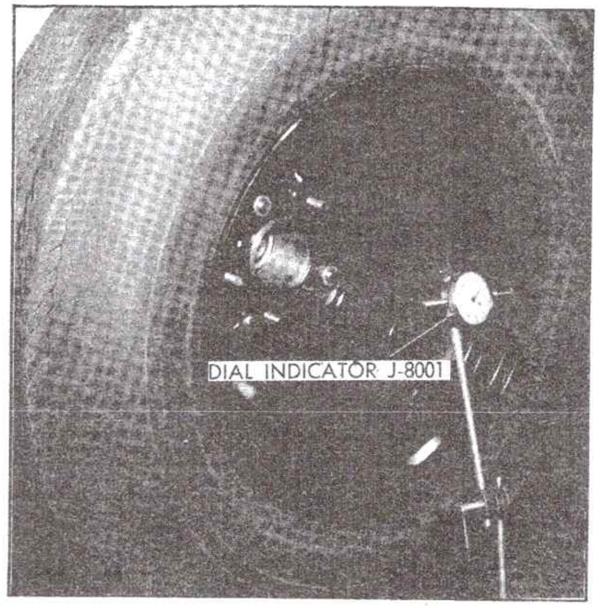


Fig. 10-11 Checking Radial Runout At Bead Seat (693 Only)

10. Repeat total runout check procedures as described in steps 3 and 5 to make certain that runout is within specifications. If runout is still not within specifications, rotate wheel assembly around mounting studs as previously described.

If proper runout for tire and wheel assembly cannot be obtained by performing above checks, and runout measurements show that wheel is within specifications, runout may be due to excessive tire runout, bolt circle runout, and/or wheel flange runout. If wheel flange or bolt circle is not the cause of excessive runout, it is an indication that the tire is responsible and it should be replaced.

If wheel runout measurements as made on car are excessive, and total tire and wheel runout cannot be reduced by the above procedures, the wheels should be replaced.

e. Wheel and Tire Balance

Wheel, tire, and brake drum balance must be maintained within certain limits, otherwise wheel tramp and high speed shimmy may result.

Front wheel tramp and front wheel shimmy are two entirely different conditions. Front wheel tramp, which usually occurs at high speed, is a condition in which a pair of wheels hop in opposite phase. It is caused by static unbalance of the wheels or drums, loose linkage in the front end, or improperly operating shock absorbers.

Shimmy may occur at lower speeds. It is a self-excited oscillation about the steering axis of the front wheels, caused by dynamic unbalance of

the wheels or drums, loose or worn front end linkage, loose or worn steering gear parts, or faulty steering gear adjustment. Tramp and shimmy will be felt in the entire car, but shimmy can also be felt at the steering wheel. Shimmy is a front wheel condition entirely, whereas tramp is possible in either front or rear wheels.

A wheel and tire assembly may lose its original balance due to normal seating-in and break-in, irregular tread wear, or tire repair. Consequently, if front end instability develops, the tire and wheel assembly should be checked for static balance. In addition, check steering gear adjustment and radial runout of the wheel and tire assembly. The assembly should also be checked for balance whenever tires are replaced, and especially in cases where non-standard tire equipment, such as heavier treads and heavier ply casings, are installed.

f. Static Balance (Stationary Balance)

Static balance is the equal distribution of weight of the wheel and tire assembly about the axis of rotation so that the assembly has no tendency to rotate by itself. Static unbalance causes the pounding action on the front wheels that is called tramp.

Diagnosis and correction of static and dynamic unbalance conditions is performed on equipment that is available commercially. In every case, follow the instructions and recommendations of the equipment manufacturer to assure accurate workmanship.

g. Dynamic Balance (Running Balance)

Dynamic balance is the equal distribution of weight of wheel and tire assembly around the plane of rotation so that the wheel runs smoothly at all speeds on the axis that runs through centerline of wheel. Dynamic unbalance causes wheel wobble at high speeds.

A wheel can be in static balance and out of dynamic balance, but a wheel in dynamic balance must also be in static balance.

CAUTION: On-car type wheel balancers are not generally recommended for use on the rear wheels of cars equipped with the optional Controlled Differential.

h. White Sidewall Cleaning

All white sidewall tires on 1967 cars have a colored protective coating that should be removed from the tires before delivery of the car. In no case should the tires be driven more than 50 miles before this coating is removed.

To remove this coating, wet the tire surface thoroughly with warm water and allow it to soak for one minute then wash, using a stiff brush or sponge with a stream of water playing on the tire surface. The coating may also be removed by steam cleaning.

Unmounted white sidewall tires should be stored with care. Do not place a tire with a white sidewall against a tire with a black sidewall because a chemical reaction may cause bleeding of the black tire and permanently discolor the white tire.

Under no circumstances should gasoline, kerosene, or any cleaning fluid containing a solvent derived from oil be used to clean white sidewall tires. Mineral oil in any form is detrimental to rubber.

3. Wheel Bearings

Tapered roller bearings are used in the front wheels, Fig. 10-12. With this design, the cone is integral with the roller assembly.

a. Front Wheel Bearing Adjustment

When adjusting front wheel bearings, raise front end of car and make sure that hub is completely seated on spindle. Rotate wheel assembly and tighten the adjusting nut to 30 foot-pounds, using a 0-50 foot-pound torque wrench. Make certain that all parts are properly seated and the threads are free. Then back off nut one quarter turn (90°).

If cotter pin cannot be installed in either of the two available holes in the spindle with nut in this position, loosen adjusting nut until cotter pin can be installed. The wheel should spin freely.

Peen end of cotter pin over sufficiently against side of nut. The cotter pin must be tight after installation. If cotter pin can be moved with finger, vibration may cause it to wear and break, ending its protection.

b. Front Wheel Bearing Removal

1. Remove wheel disc.

2. Raise front end of car.

3. Remove wheel assembly from brake drum.

4. Remove dust cap, cotter pin, spindle nut, washer, and outer cone and roller assembly, Fig. 10-12.

5. Remove brake drum from steering knuckle spindle.

6. Remove inner bearing grease retainer, and cone and roller assembly.

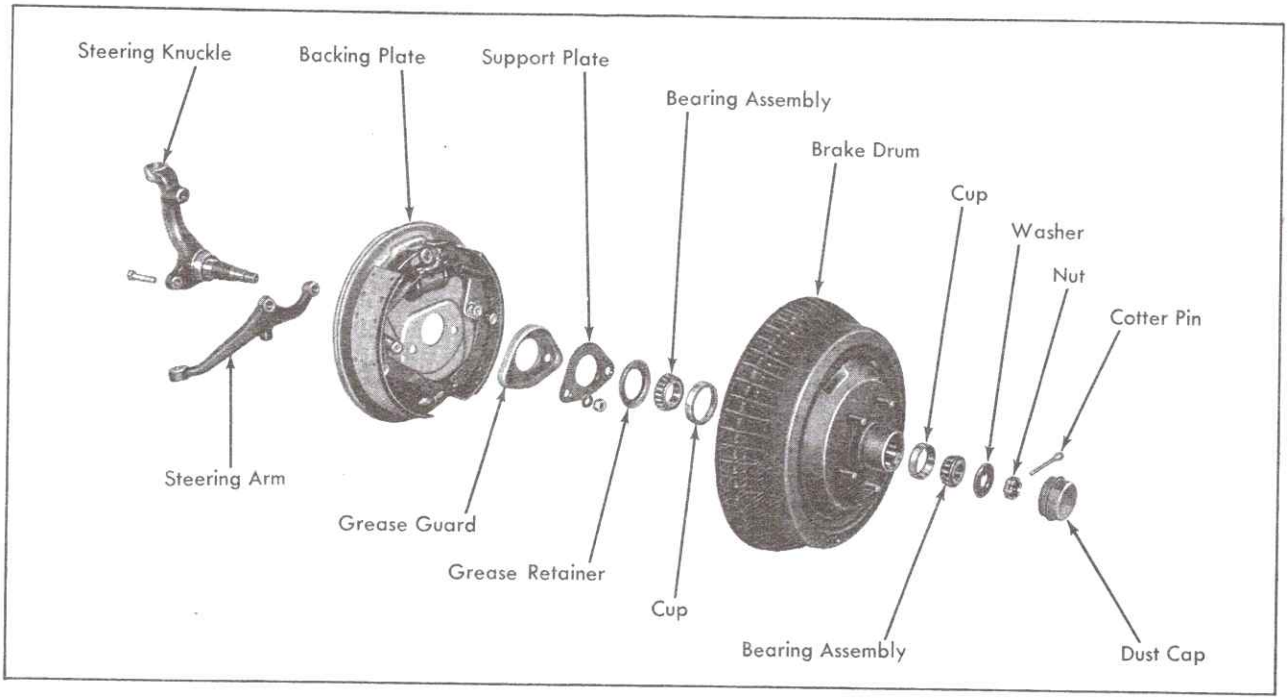


Fig. 10-12 Front Wheel Disassembled

NOTE: A simple tool, Fig. 10-13 may be made out of cold rolled steel or from an old screwdriver to facilitate removal of the grease retainer. Use of this tool will prevent possible damage to inner bearing assembly and hub surface when removing retainer.

7. Inner and outer bearing cups are a press fit in hub, and can be removed by driving out from opposite side with a long punch.

NOTE: Discolored stripes on bearing races of new cars do not necessarily indicate a rough bearing race.

c. Front Wheel Bearing Installation

1. Clean cone and roller assemblies and cups thoroughly, replacing the complete assembly if any parts are worn, pitted, or rough.

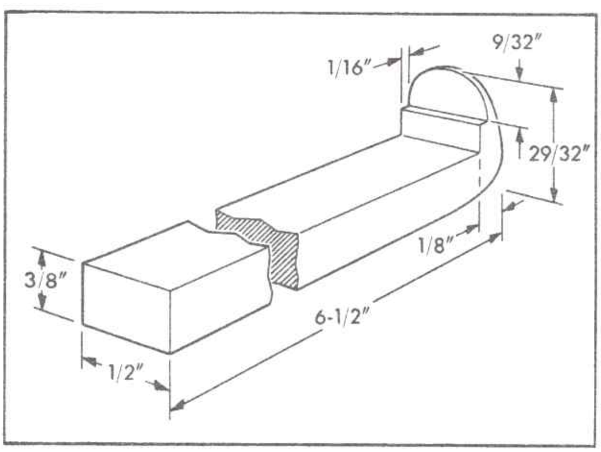


Fig. 10-13 Grease Retainer Remover Tool

2. Pack bearing cages with high melting point grade 2 grease. Use a commercial bearing packer or pack bearings by hand. Force grease in at large end of cage until it protrudes from the small end.

3. Install outer bearing cup, using Front Hub Outer Bearing Cup Installer, J-8457, and Handle, J-8092. Use arbor press to install bearing cup in

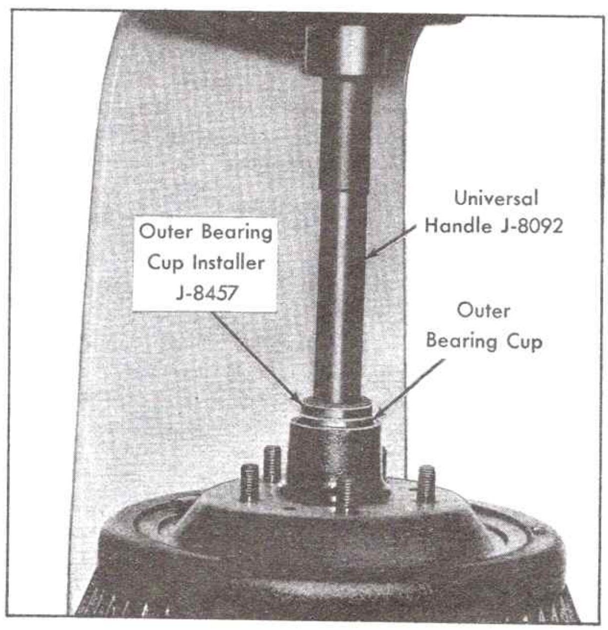


Fig. 10-14 Installing Outer Bearing Cup

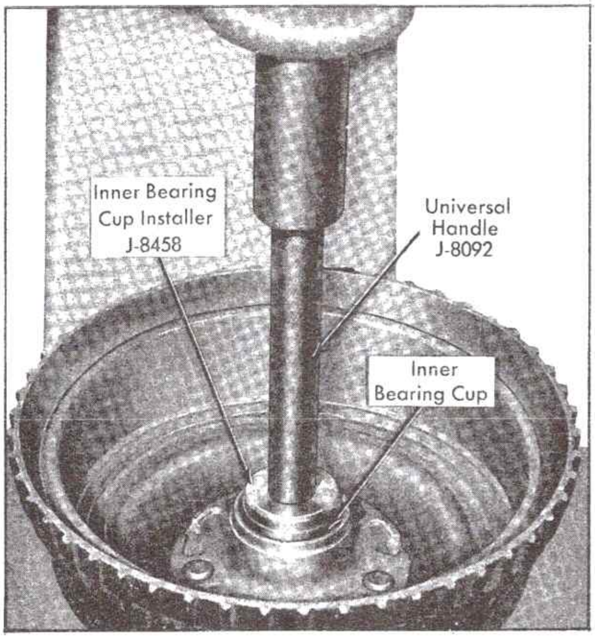


Fig. 10-15 Installing Inner Bearing Cup

hub, Fig. 10-14, supporting front hub and drum assembly on flange area of hub.

4. Install inner bearing cup, using Front Hub Inner Bearing Cup Installer, J-8458, and Handle, J-8092. Use arbor press to install bearing cup in hub, Fig. 10-15.

5. Place inner bearing cone and roller assembly in inner bearing cup.

6. Install new grease retainer, using Front Wheel Hub Grease Retainer Installer, J-8456, and Handle J-8092. Use arbor press to install grease retainer in hub, Fig. 10-16.

7. Wipe steering knuckle clean and apply a thin film of wheel bearing grease to spindle.

8. Install brake drum on steering knuckle spindle.

9. Place outer bearing cone and roller assembly in outer bearing cup.

10. Install washer and wheel nut.

11. Install wheel assembly on brake drum and tighten wheel mounting nuts to 105 foot pounds.

12. Adjust wheel bearings as described in Note 3a.

13. Replace dust cap and wheel disc and lower car.

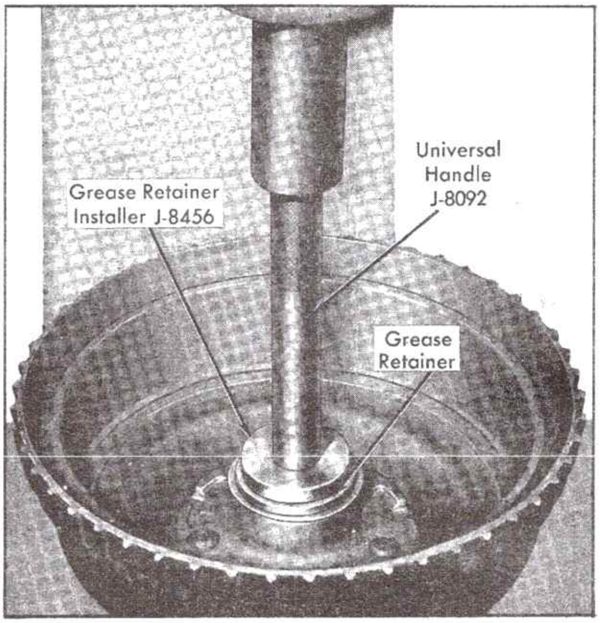


Fig. 10-16 Installing Grease Retainer

SPECIFICATIONS

Item	All Styles Unless Otherwise Noted
Wheels	
Rim Diameter	15"
Rim Width	6"
Radial Runout - Maximum	.035"
Lateral Runout - Maximum	.045"
Tread	
Front and Rear -	
680, 681, 682 and 683	62.5"
Fleetwood Eldorado	
Front	63.5"
Rear	63"

Item	All Styles Unless Otherwise Noted
Front and Rear -	
Fleetwood Seventy-Five	
Sedans and Limousines	62.5"
Front - Commercial Chassis	62.5"
Rear - Commercial Chassis	65"
Wheel and Tire	
Radial and Lateral Runout -	
Maximum	.050"

DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Front wheel shimmy.	Wheels, tires or brake drums out of balance.	Balance wheels and tires.
	Wheels or tires out of round.	Check for tire and wheel wobble or out of round. See that wheels and tires are properly mounted.
	Rough tire.	Isolate and replace.
	Steering gear or steering connections incorrectly adjusted or worn.	Check and adjust to specification.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Damaged spherical joint seals.	Replace and repack seals.
	Front wheel bearings incorrectly adjusted or worn.	Adjust or replace if necessary.
	Shock absorbers inoperative.	Check and replace if necessary.
Hard riding.	Excessive friction in front suspension.	Check spherical joint seals for damage. If necessary replace seals and repack joints.
	Tires overinflated.	Correct tire pressure.
	Shock absorbers.	Check and replace if necessary.
	Springs with incorrect rating being used.	Install springs with correct rating.

SPECIAL TOOLS

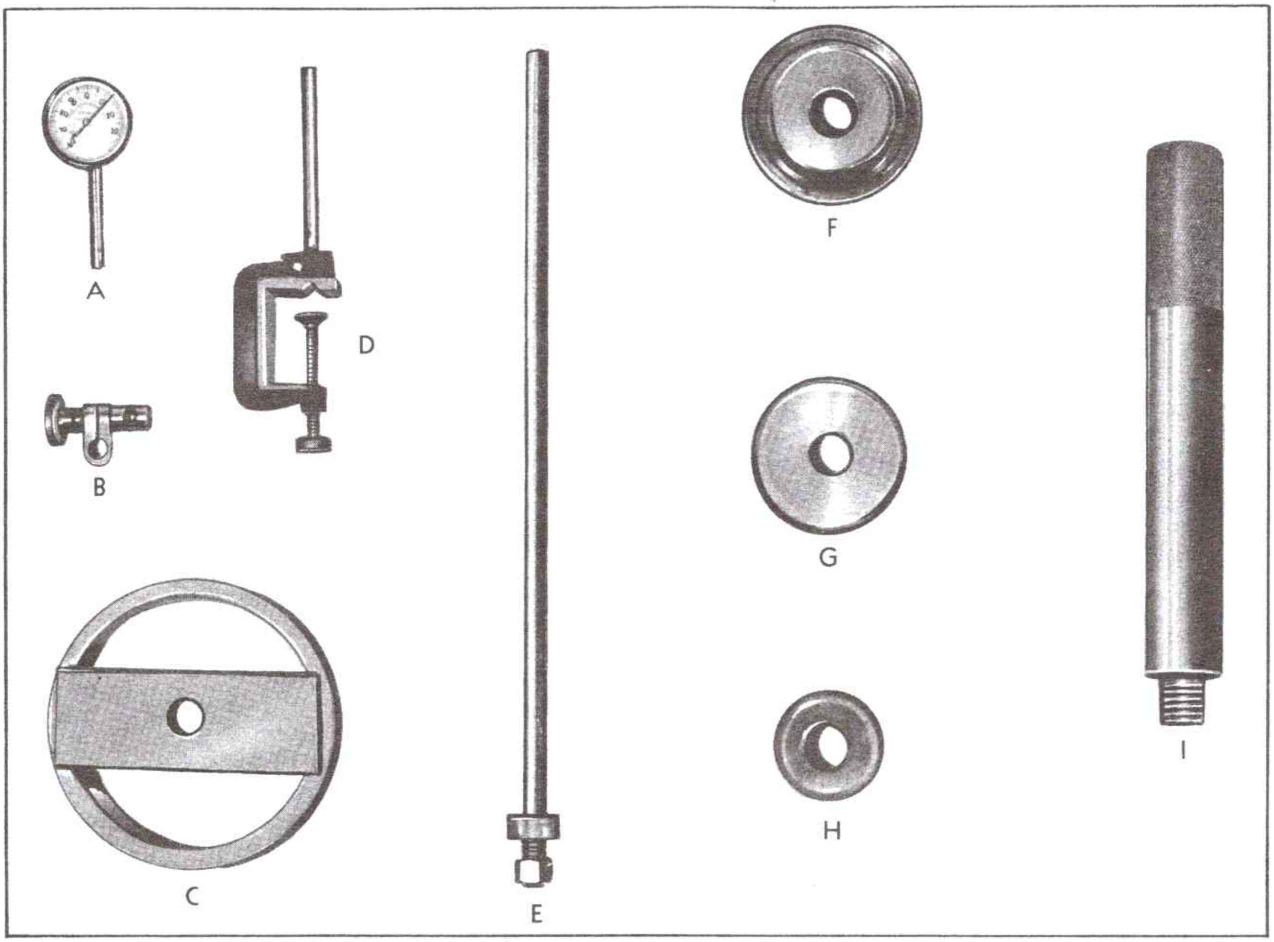


Fig. 10-17 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8001-3	Dial Indicator	F	J-8456	Front Hub Grease Retainer Installer
B	J-8001-2	Sleeve	G	J-8458	Front Hub Inner Bearing Cup Installer
C	J-4353	Dial Indicator Support Base	H	J-8457	Front Hub Outer Bearing Cup Installer
D	J-8001-1	Clamp	I	J-8092	Universal Handle (use with J-8456, J-8457 and J-8458)
E	J-6126	Dial Indicator Support			

GENERAL DESCRIPTION

The 1967 Cadillac sheet metal described in this section consists of the following items: hood, front fenders, and wheel housings.

The hood is hinged near the cowl and opens from the front. Dual hood latches are located on the right and left ends of the hood inner panel and are linked together with a tie bar. The hood is opened by pushing upward on the hood release lever that is accessible between the grille and hood panel, just to the right of the hood centerline as you face the vehicle. The lever first releases the pilot latches and then the secondary latch, permitting the hood to be raised.

The front fender assemblies provide mounting attachments that incorporate the turn indicator light assemblies, cornering light assemblies, and upper and lower head light assemblies.

SERVICE INFORMATION

1. Hood Latch Mechanism Adjustment

The hood latch assembly is attached to the hood inner panel by eight screws, Fig. 11-1, three at each latch and two at the center support bracket. The hood latch pilots, Fig. 11-2, are each attached to the tie bar by one nut plate on the underside of the tie bar and an adjustable locknut on top of the tie bar. (See Fig. 11-7, and Fig. 11-8, for 693 Style)

The pilots may be adjusted vertically by loosening the adjustable locknut, rotating the pilots up or down as required, and then tightening the locknut. Enlarged holes in the hood latch pilot tie bar provide for side-to-side and fore-and-aft adjustment of the hood latch pilots.

When the hood latch assembly or the hood latch pilots have been removed, the mounting screws loosened, or the hood adjustment changed, make certain that the proper alignment has been obtained before tightening the pilot locknut. Failure to do so may result in damage to the latching assembly due to misalignment when the hood is closed.

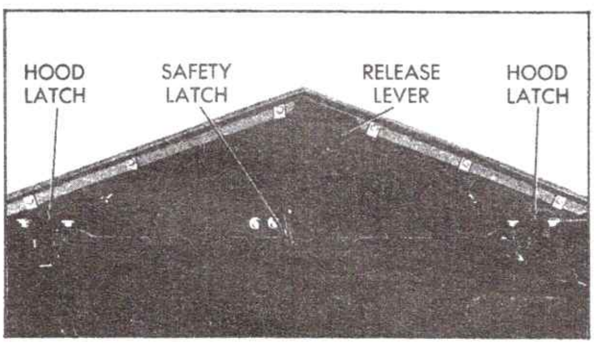


Fig. 11-1 Head Latch Assembly

2. Hood Panel— Removal and Installation

a. Removal (Figs. 11-3 and 11-9)

1. Scribe hinge locations on underside of hood panel to aid in repositioning the hood when it is re-installed.

2. Remove six screws and washers, three each side, retaining hinge assemblies to hood panel.

3. Remove hood with the aid of a helper, using care to avoid damaging finish.

b. Installation (Figs. 11-3 and 11-9)

NOTE: Install an exhaust manifold stud in center holes of hood retaining plate to help locate and position adjusting screws when installing hood.

1. With the aid of a helper, place hood in position on hood hinge assemblies and loosely install three screws and washers at each hinge assembly.

2. Position hood so that hinges line up with scribe marks and tighten screws at each hinge.

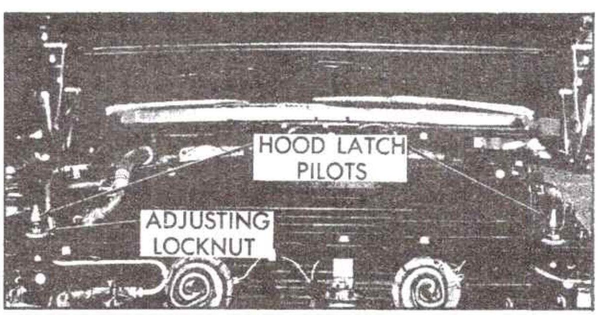


Fig. 11-2 Hood Latch Pilots

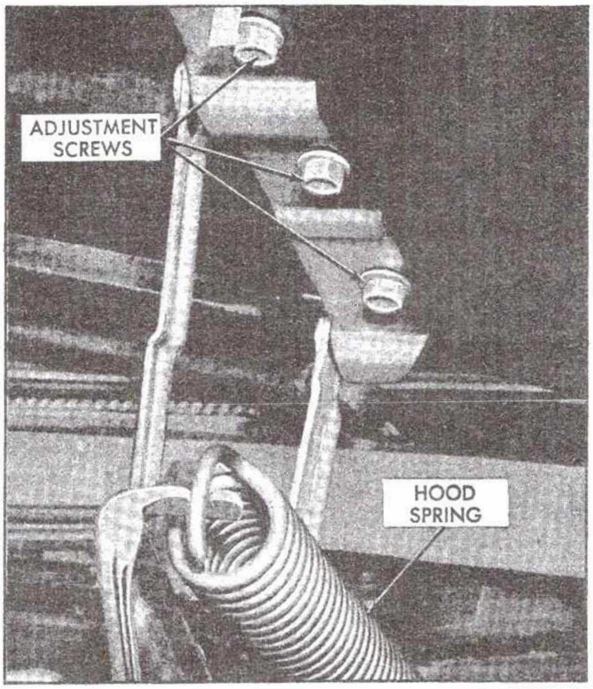


Fig. 11-3 Hood Hinge

3. Carefully close hood and check alignment of hood at cowl, fender, and grille opening.

4. Align hood to cowl, if necessary, as described in Note 3.

5. Adjust hood to fender, if necessary, as described in Note 7a.

6. Adjust hood latch mechanism as described in Note 1.

3. Hood Adjustment

1. Loosen hood attaching screws, three at each hood hinge, Fig. 11-3. Elongated holes in hinge provide fore, aft, and side adjustment of hood.

2. Position hood so that clearance between rear edge of hood panel and cowl air intake grille is 1/4 inch.

3. Position variable thickness rubber bumpers in channel hood lacing along top edge of cowl, Fig. 11-4, to support hood panel flush in relation to cowl air intake grille.

NOTE: Variable thickness rubber bumpers are available from your servicing Parts Warehouse.

4. Tighten hinge to hood attaching screws on both sides.

5. Adjust rubber bumpers, located on each front fender front reinforcement, so that hood panel is flush with fenders at this point.

6. Fender to hood adjustment is covered in Note 7a.

7. Adjust hood latch mechanism as described in Note 1.

4. Hood Hinge Spring— Removal and Installation

a. Removal (Fig. 11-3)

1. Open hood and prop as high as possible.

2. Using a strong wire hook, attach one end to center of pry bar of sufficient length and the other end to hinge spring.

3. With the aid of a helper, lift pry bar until spring disengages from hood hinge, then release pressure on bar slowly until spring is loose, then unhook other end of spring from hinge.

b. Installation (Fig. 11-3)

1. Hook one end of spring on hinge, then with the aid of a helper, use pry bar and wire hook to connect spring to front of hinge.

5. Front Fender Removal and Installation— Right or Left

a. Removal (Fig. 11-5)

1. If left fender is to be removed, disconnect negative battery cable. If right front fender is to be removed, remove battery.

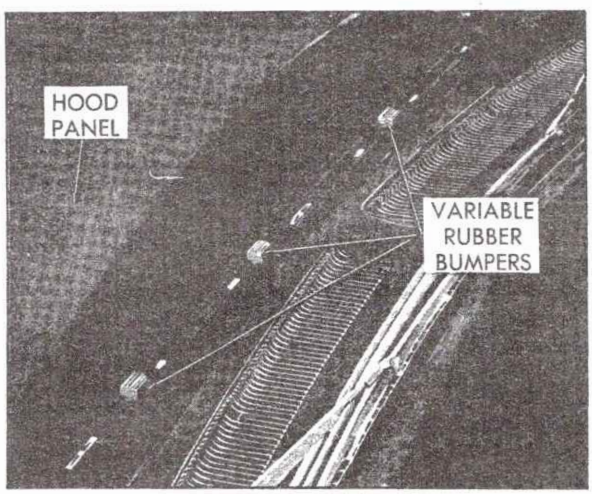


Fig. 11-4 Adjusting Hood to Cowl

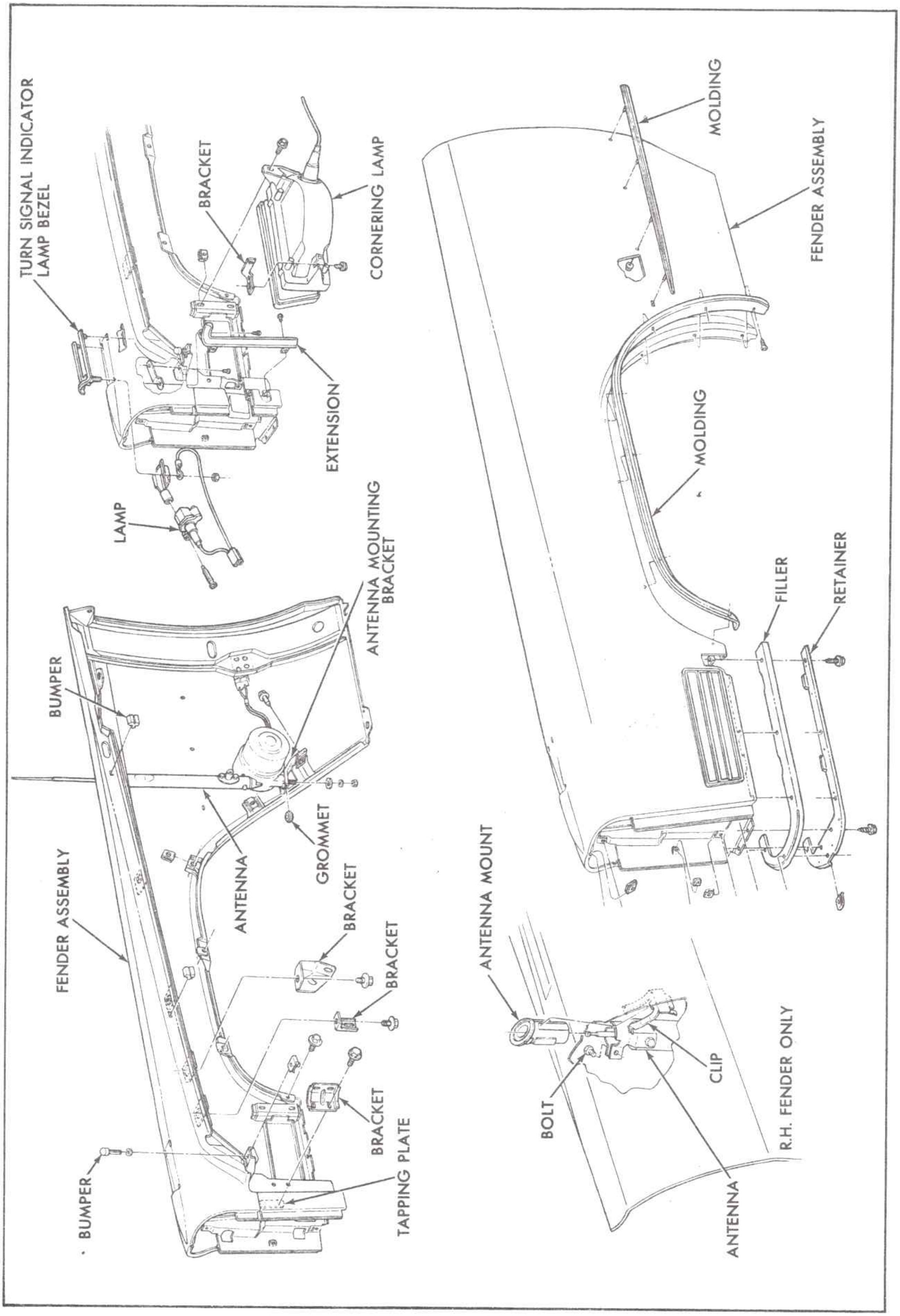


Fig. 11-5 Front Fender Disassembled

2. If right front fender is to be removed, remove antenna as described in Section 15, Note 12a.

3. Raise front end of car and support on jackstands. Remove wheel at fender being removed.

4. Remove headlight assembly as follows:

a. Remove three screws holding headlight bezel to fender and remove bezel.

b. Remove four screws securing headlight assembly to fender.

c. Disconnect headlight leads and remove headlight assembly.

5. Reaching through headlight opening, remove one nut and flat washer from bumper restrictor.

6. Remove two screws with flat washers that secure two angle brackets near radiator cradle.

7. Remove two screws with flat washers that hold fender to wheel house from inside wheel house.

8. Remove five screws that secure fender to wheel house at edge of fender.

> NOTE: In Steps 9 and 10, note number of shims so same number may be installed during assembly.

9. Remove one screw with lockwasher and shims at rear edge of fender near rocker panel.

10. Remove one screw with flat washer and shims securing fender to body at cowl.

11. Remove two sheet metal screws securing upper filler panel in door hinge area for access to screw. Remove screw with flat washer from door hinge area.

12. Remove two sheet metal screws securing lower filler panel to door hinge area and remove filler.

13. Disconnect indicator lamp and cornering lamp wires at connector accessible in headlight opening.

14. Remove two screws with flat washers securing bracket from radiator cradle to fender. These are accessible behind splash shield in wheel housing.

15. Apply masking tape to front edge of door to avoid scratching finish when removing fender.

16. Remove fender by lifting outward and slightly forward.

b. Installation (Fig. 11-5)

All fender attaching bolts should be loosely installed until fender alignment is obtained. Then tighten to proper torque specifications. Loosen wheel housing attaching screws if necessary to align fender properly.

1. Position fender in approximate location, making sure wheel housing is in proper position at edge of fender.

> NOTE: In Steps 2 and 3 install shims required to obtain tolerances as shown on page 11-7, referring to Fig. 11-6.

2. Install screw with flat washer at cowl securing fender to cowl.

3. Install screw with flat washer securing fender in rocker panel area.

4. Install two screws with flat washers securing two angle brackets at radiator cradle.

5. Install two screws with flat washers securing fender to wheel housing from inside wheel housing.

6. Install five screws securing fender to wheel housing at edge of fender.

7. Feed turn indicator and cornering lamp wires through fender to proper position.

8. Install two screws with flat washers securing angle bracket from radiator cradle to fender accessible behind splash shield inside wheel housing.

9. Install two screws in door hinge area.

10. Obtain proper alignment of fender as shown in Fig. 11-6 and tighten all screws installed in steps 2 through 9 to proper torque as shown in chart on page 11-7.

11. Position filler panels in door hinge area and secure with sheet metal screws.

12. Install nut and flat washer on bumper restrictor stud and tighten.

13. Connect turn indicator lamp and cornering lamp connectors accessible inside headlight opening.

14. Install headlight assembly as follows:

a. Connect headlight leads and position headlight assembly in fender.

b. Secure headlight assembly with four screws.

c. Position headlight bezel to fender and secure with three screws.

15. Install or connect battery as required.

16. Install antenna if right front fender was replaced.

17. Remove jackstands and lower car to floor.

6. Front Fender Wheel Housing Removal and Installation—Right or Left

a. Removal

1. Remove front fender as described in Note 5a.

2. Disconnect underhood wiring harness from retainer clips on wheel housing.

3. When removing right wheel housing, proceed as follows:

a. Disconnect multiple connector at voltage regulator and remove screw securing ground wires.

b. Disconnect leads to seat heater relay located near hood hinge support (if equipped with seat heater).

c. Remove two nuts and bolts securing water control valve bracket, and one clip securing vacuum hoses to wheel housing.

d. Remove plastic clip retaining battery cable to wheel housing.

e. If car is equipped with Automatic Climate Control, remove high pressure liquid line from retaining clip.

4. If left wheel housing is being removed, proceed as follows:

a. Remove power steering cooler, if so equipped, from left wheel housing.

b. If vehicle is equipped with Cruise Control, remove power unit from left wheel housing as described in Section 15, Note 28a.

c. Remove windshield washer solvent container.

5. Remove two screws, lock washers, flat washers, and nuts that hold lower front of wheel housing to forward part of radiator cradle.

6. Remove bolt and flat washer that retain mud deflector to bracket on front bumper lower end.

7. Remove two nuts, bolt retainer, lock washer and flat washer, and one bolt, flat washer and lock washer that hold wheel housing to radiator cradle bracket behind radiator assembly.

8. Remove four bolts with nuts, lock washers and flat washers that secure lower rear of wheel housing to lower strut.

9. Remove two nuts, flat washers and lock washers securing strut rod to top of wheel housing.

10. Remove two screws, retaining plate, lock washer and flat washers that secure wheel housing to hood hinge assembly bracket, and remove wheel housing.

b. Installation

1. Position wheel housing on car and loosely install two screws, retaining plate, lock washers and flat washers that secure hood hinge assembly to wheel housing bracket.

2. Loosely install bolts and retainer, lock washers, flat washers, and nuts that secure lower rear of wheel housing to lower strut.

3. Loosely install two nuts, bolt retainer, lock washers and flat washers, and one bolt, flat washer and lock washer that hold wheel housing to radiator cradle bracket behind radiator assembly.

4. Loosely install two screws, lock washers and flat washers, and nuts that secure lower front of wheel housing to forward part of radiator cradle.

5. Install bolt and flat washer securing mud deflector to bracket on front bumper lower end.

6. Loosely install two nuts, flat washers and lock washers securing strut rod to top of wheel housing.

7. Check alignment of wheel housing and tighten all attaching nuts, bolts, and screws.

8. If right wheel housing is being installed, proceed as follows:

a. If equipped with Automatic Climate Control, install high pressure liquid line to retaining clip.

b. Install battery cable in plastic clip on wheel housing.

c. Install two bolts and nuts securing water control valve bracket and secure vacuum hoses and clip to wheel housing.

d. Connect leads to seat heater relay located near hood hinge support (if equipped).

e. Connect multiple connector to voltage regulator and install screw securing ground wires.

9. If left wheel housing is being installed, proceed as follows:

a. Install power steering cooler, if so equipped, on wheel housing.

b. If vehicle is equipped with Cruise Control, install power unit on wheel housing as described in Section 15, Note 28b.

c. Install windshield washer solvent container.

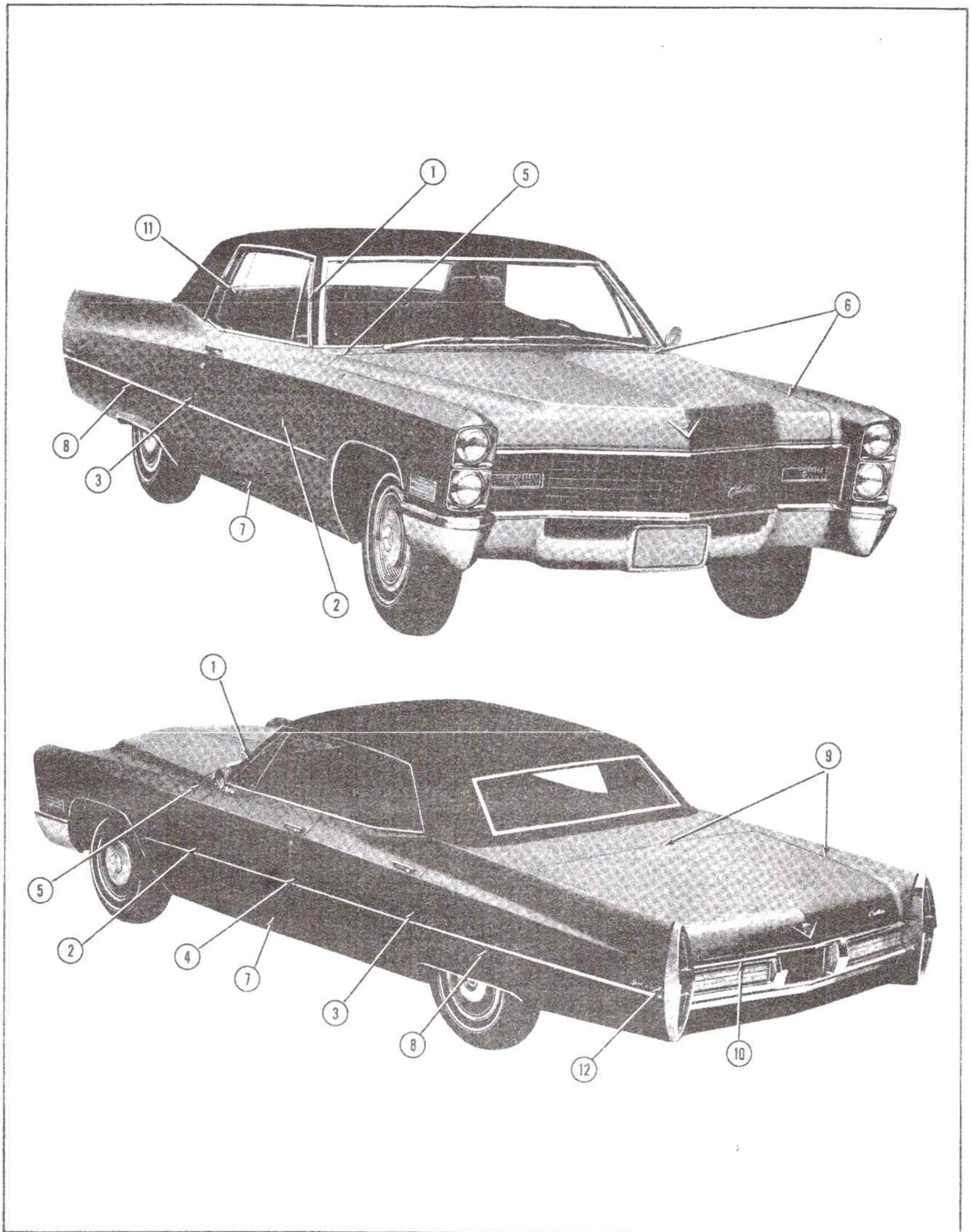


Fig. 11-6 Sheet Metal Tolerances

10. Connect underhood wiring harness to retainer clips on wheel housing.

11. Install front fender as described in Note 5b.

7. Adjusting Sheet Metal Tolerances

a. Front Fender

1. Loosen all screws at the following locations:

a. Fender reinforcement to radiator cradle bracket.

b. Cowl

c. Front hinge pillar

d. Rocker panel extension to underside of fender.

e. Fender to wheel housing inside of wheel opening.

2. Remove rubber bumpers that fit between fender and hood.

3. Adjust fender so that clearances are as shown in the following table.

NOTE: Refering to Fig. 11-6, the clearance at points #2 and #5 should also be adjusted at this time. Refer to chart below for tolerances.

4. After obtaining adjustment, tighten all screws to proper torque specifications as shown at the end of this section.

5. Install rubber bumpers that fit between fender and hood.

b. All Body Clearances

The adjustment procedures for clearances 1 thru 12 in Fig. 11-6 (except #2 and #5) are found in the 1967 Fisher Body Service Manual. These clearances should be adjusted to the figures shown in the following table.

SHEET METAL TOLERANCES

Location	Style	Clearance Gap	Flushness
1. Side window to windshield	All except 23 and 33	3/8-7/16	—
	23 and 33	1/8-1/4	—
2. Door to Fender	All	1/8-1/4	± 1/16
3. Door to Quarter Panel	All	1/8-1/4	+ 0 - 1/16
4. Front Door to Rear Door	All	1/8-1/4	+0 - 1/16
5. Fender to Cowl	All	1/16-5/32	± 1/16
6. Hood to Fender or Cowl	All	3/32-5/32	± 1/16
7. Door to Rocker Panel	All	1/8-1/4	—
8. Wheel Skirt to Quarter Panel	All	1/8-1/4	± 1/16
9. Trunk Lid to Fender	All	1/16-1/4	± 1/16
10. Trunk Lid to Bumper	All	5/16-7/16	—
11. Windows	49, 47 & 67 only	5/16-3/8	*
12. Bumper to Quarter Panel	All	3/8-11/16	—

*May be out of plane if weatherstrip provides watertight seal.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
260M	Hood Hinge to Hood	3/8-16	25
260M	Hood Hinge to Cowl	3/8-16	30
260M	Front Fender to Radiator Cradle	3/8-16	25
Special	Front Fender to Cowl	3/8-16	25
Special	Front Fender to Rocker Panel	3/8-16	25
Special	Front Fender to Hinge Pillar	3/8-16	25

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.

CHASSIS SHEET METAL

The service information that follows pertains only to the Fleetwood Eldorado. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as given in the first part of this section.

SERVICE INFORMATION

8. Front Fender (Right or Left)—Removal and Installation

a. Removal

1. Disconnect negative battery cable. If right fender is being removed, remove radio antenna as described in Section 15, Note 12a.

2. Raise front of car, support on jack stands, and remove wheel at fender being replaced.

3. Disconnect wiring connectors for cornering light and turn signal indicator.

4. Open front door and remove two screws securing filler panel to hinge pillar and remove filler panel. Remove one screw with washer and shims securing fender to hinge pillar.

5. Remove fender attaching screw with washer and shims from top of cowl. Note number and arrangement of shims.

6. Remove three screws and washers securing fender to rocker panel. Note number and arrangement of shims.

7. Remove five screws securing fender to wheel housing at fender opening.

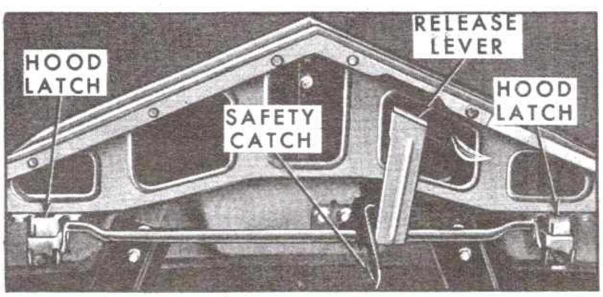


Fig. 11-7 Hood Latch - 693 (See Note 11-1)

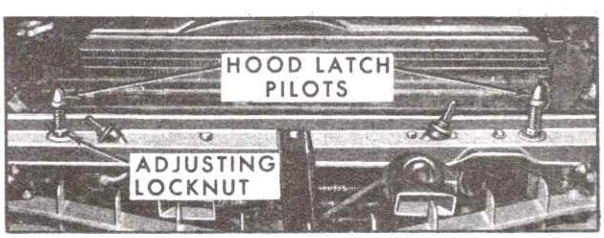


Fig. 11-8 Hood Pilots - 693 (See Note 11-1)

8. Remove two screws and washers from inside wheel housing that hold fender to wheel housing at top.

9. Remove two screws and washers from radiator support area.

10. Remove screw securing lower support rod to radiator cradle at radiator cradle which is accessible underneath fender at front.

11. Apply masking tape to leading edge of door to avoid scratching finish during fender removal.

12. Remove fender from vehicle by lifting outward and slightly forward.

b. Installation

NOTE: All fender attaching bolts and screws should be loosely installed until alignment of fender is obtained. Then tighten to proper

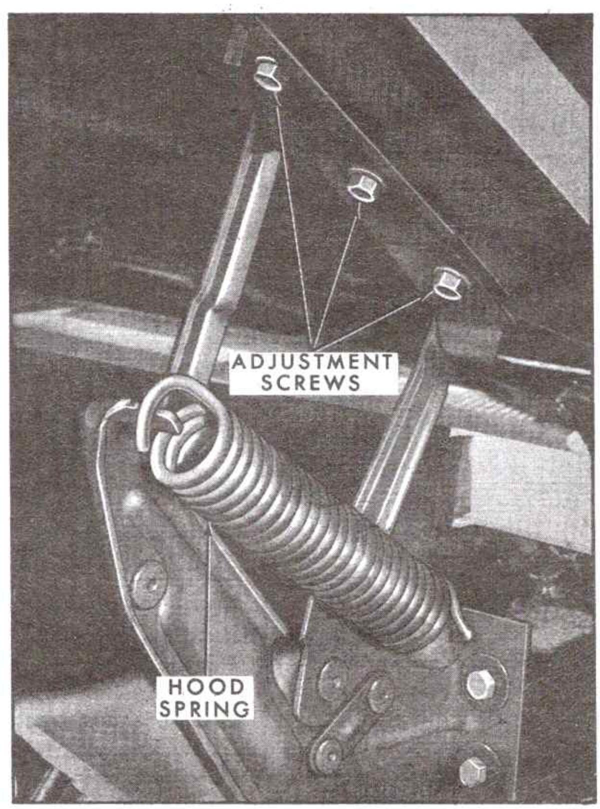


Fig. 11-9 Hood Hinge - 693 (See Note 11-2)

torque specifications. Loosen wheel housing attaching screws if necessary to align fender properly.

1. Position fender in approximate location making sure wheel housing is in proper position at edge of fender.

2. Position rubber filler panel behind bumper.

NOTE: In the following steps, install proper number of shims necessary to obtain tolerances shown on page 11-13, referring to Fig. 11-12.

3. Install screw with washer at top of cowl securing fender to cowl.

4. Install three screws with washers securing fender to rocker panel.

5. Install two screws with washers securing fender to radiator cradle.

6. Install five screws securing wheel housing to fender at wheel opening.

7. Install two screws and washers that secure wheel housing to fender at top of housing working from inside fender.

8. Install screw with washer securing fender to door pillar in door hinge area.

9. Install screw securing lower support rod to radiator cradle.

10. Check alignment and tighten all screws to proper torque.

11. Connect wiring connectors for cornering light and turn signal indicator.

12. Install wheel and lower car to ground.

13. Install radio antenna as described in Section 15, Note 12b, if removed, and reconnect negative battery cable.

14. Remove masking tape from leading edge of door.

9. Fender Cap (Right or Left)— Removal and Installation

a. Removal (Fig. 11-10)

1. Lower headlamp door by pressing downward.

2. Reach behind fender cap and remove four nuts and washers securing fender cap to fender and remove fender cap.

b. Installation (Fig. 11-10)

1. Position fender cap in proper location on fender, align and secure with four nuts and washers.

2. Raise headlamp door.

10. Front Fender Wheel Housing (Right or Left)— Removal and Installation

a. Removal

1. Remove fender as described in Note 8a.

2. Remove two bolts, nuts and flat washers holding cowl to wheel housing tie strut at wheel housing and position tie strut out of way.

3. Remove two screws securing hood hinge angle bracket to wheel housing.

4. If removing right hand wheel housing proceed as follows:

a. Remove heater hoses from clip on wheel housing and position hoses out of way.

b. Remove two bolts and nuts holding water control valve to wheel housing and position valve out of way (A/C only).

c. Disconnect wires from seat heater relay (seat heater only).

5. If removing left hand wheel housing, proceed as follows:

a. Remove two screws securing vacuum storage tank to wheel housing (A/C only).

6. Remove wiring harnesses from wheel housing to avoid damage.

7. Remove two bolts with nuts, lock washers and flat washers securing wheel housing to frame at rear of wheel housing.

8. Remove two bolts with nuts, lock washers and flat washers securing wheel housing to radiator cradle at leading edge of wheel housing.

9. Remove three bolts with nuts and washers securing wheel housing to radiator cradle angle bracket.

10. Remove wheel housing from car.

b. Installation

1. Position wheel housing in approximate location.

2. Loosely install two screws securing hood hinge to wheel housing.

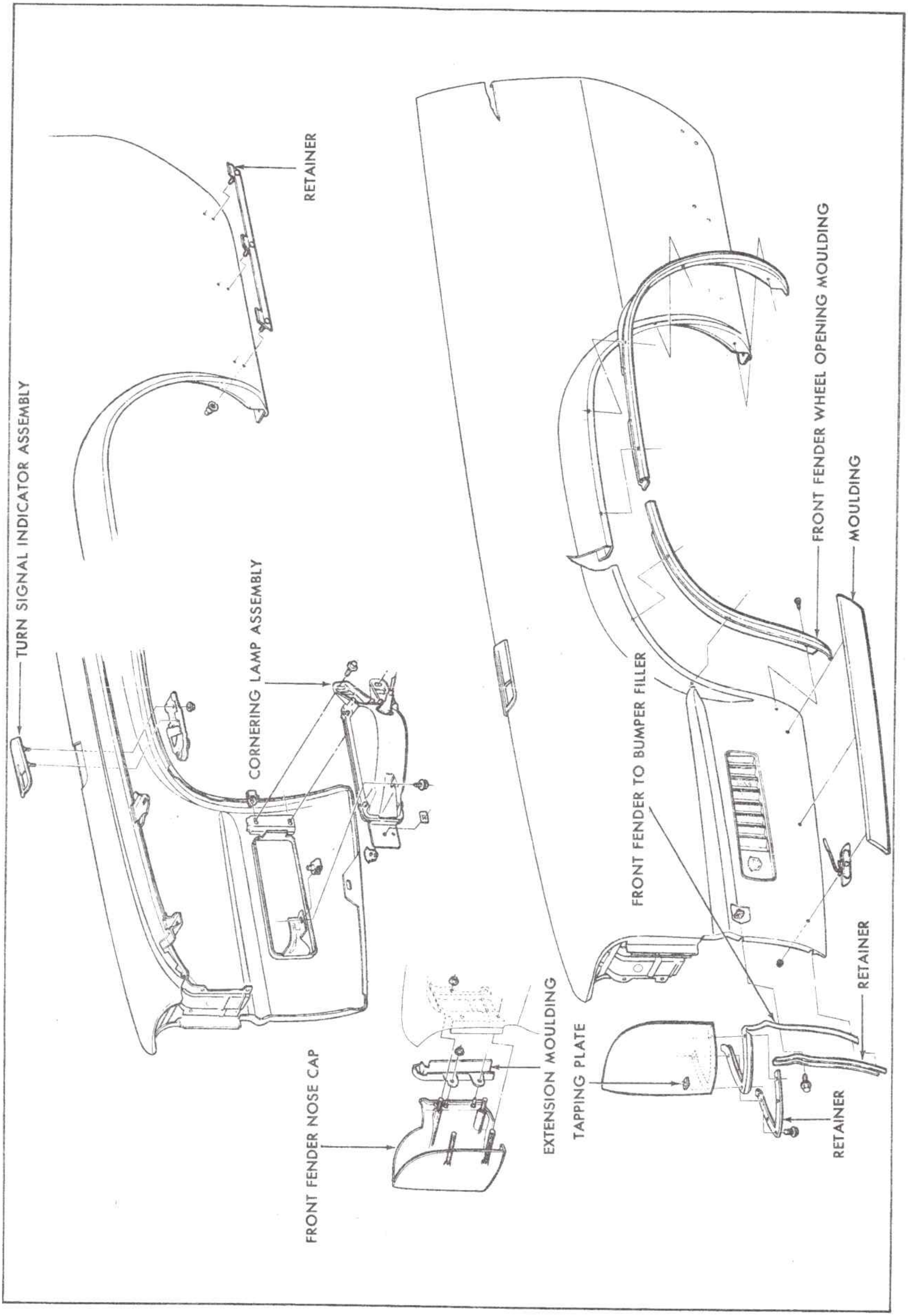


Fig. 11-10 Front Fender Disassembled

3. Loosely install two bolts with nuts, lock washers and flat washers that secure wheel housing to radiator cradle at leading edge of wheel housing.

4. Loosely install three bolts with nuts, lock washers and flat washers that secure wheel housing to radiator cradle angle bracket.

5. Loosely install three bolts with nuts and flat washers securing rear of wheel housing to frame.

6. Tighten bolts installed in steps 2 thru 5.

7. Install wiring harnesses in their proper routings.

8. If installing right hand wheel housing proceed as follows:

a. Install heater hoses under clip on wheel housing.

b. Install two bolts with nuts securing water control valve to wheel housing (A/C only).

c. Connect wires to seat heater relay on wheel housing (seat heater only).

9. If installing left hand wheel housing, install two screws securing vacuum storage tank to wheel housing (A/C only).

10. Install two bolts with nuts and flat washers that secure cowl to wheel-housing tie strut at wheel housing.

11. Install fender as described in Note 8b.

11. Fuel Tank Filler Door— Removal and Installation

a. Removal

1. Open rear compartment lid.

2. Remove two screws and washers securing fuel tank filler door and remove door.

b. Installation

1. Position fuel tank filler door and loosely install two screws and washers.

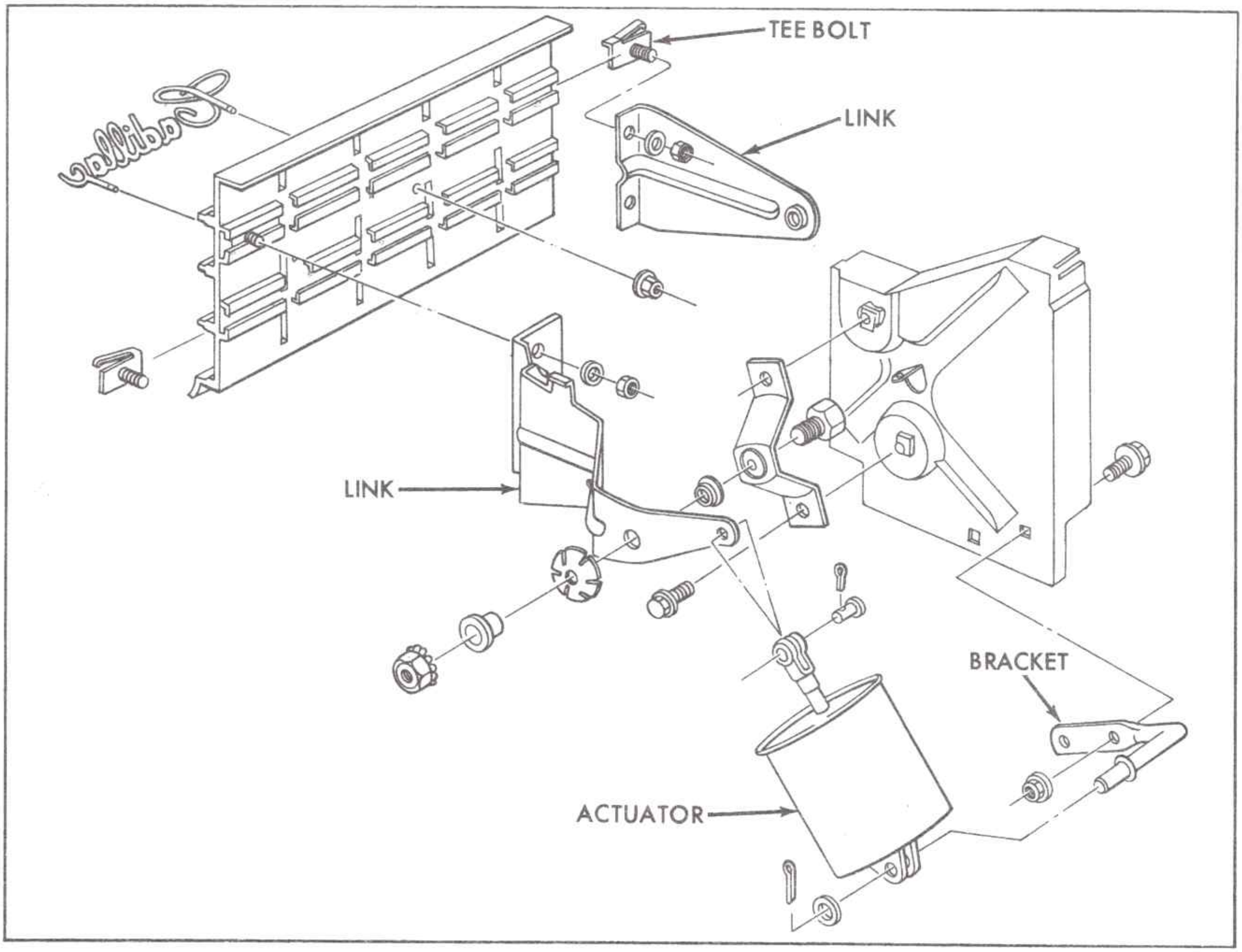


Fig. 11-11 Headlamp Vacuum Actuators

2. Align door and tighten screws.

12. Headlamp Actuator (Right or Left) Removal and Installation

a. Removal (Fig. 11-11)

1. On cars equipped with A. I. R., remove air pump air cleaner from bracket on left wheel housing. Also remove two screws securing bracket to wheel housing and remove bracket.

2. Remove rubber splash shield attaching clips behind radiator cradle.

3. Remove upper and lower vacuum hoses from actuator. Note color code for assembly.

4. Remove cotter pin and washer from lower pivot. Remove cotter pin from clevis at upper pivot and remove clevis.

5. Remove vacuum actuator assembly.

b. Installation (Fig. 11-11)

1. Locate actuator on pivots in proper position.

2. Secure lower pivot with washer and cotter pin.

3. Install clevis pin in clevis at upper pivot and secure with cotter pin.

4. Route vacuum hoses through rubber splash shield and connect to actuator observing color code.

5. Secure rubber splash shield to radiator cradle with clips.

6. Install air pump air cleaner on left wheel housing on cars equipped with A. I. R.

13. Headlamp Vacuum Storage Tank—Removal and Installation

a. Removal

1. Remove upper attaching screw at top of storage tank.

2. If car is equipped with A.I.R., remove air filter from behind radiator cradle by removing the retaining spring and lifting filter out of bracket.

3. Remove vacuum hose through access hole in back of radiator cradle.

4. Remove two nuts with lock washers securing angle bracket at leading edge of wheel housing and remove angle bracket.

5. Remove two lower attaching screws at bottom of radiator cradle.

6. Carefully remove vacuum tank from radiator cradle.

b. Installation

1. Position vacuum tank in radiator cradle and secure with three screws.

2. Connect vacuum hose to storage tank through access hole in radiator cradle.

3. Install angle bracket at leading edge of wheel housing and secure with two nuts with lock washers.

4. On cars equipped with A.I.R., install air filter in bracket on wheel housing and secure by fastening retaining spring.

14. Headlamp Door Control Switch—Removal and Installation

a. Removal

1. On cars equipped with A.I.R., remove air filter from bracket on wheel housing by removing the retaining spring and lifting the filter out of its bracket.

2. Disconnect light blue feed wire from control switch.

3. Remove vacuum hoses from control switch noting the color code.

4. Remove two attaching screws and remove control valve from vehicle.

b. Installation

1. Position control valve on radiator cradle and secure with two screws.

2. Connect vacuum hoses to control valve observing color code.

3. Connect light blue feed wire to control switch.

4. On cars equipped with A.I.R., install air filter in bracket on wheel housing and secure with retaining spring.

15. Adjusting Sheet Metal Tolerances

All body clearances, Fig. 11-12.

The adjustment procedures for clearances 1 through 10 in Fig. 11-12, except #2 and #5, are found in the 1967 Fisher Body Service Manual.

Clearances #2 and #5 should be adjusted by the same procedure as for the standard car outlined in Note 7b.

These clearances should be adjusted to the figures shown in the following table.

1967 CADILLAC FLEETWOOD ELDORADO SHEET METAL TOLERANCES

Location	Tolerance	Flushness
1. Side window to windshield	3/8-7/16	–
2. Door to Quarter Panel	7/32-9/32	±1/16
3. Door to Fender	1/8-1/4	±1/16
4. Fender to Cowl	1/8-1/4	±1/16
5. Hood to Fender or Cowl	3/32-5/32	±1/16
6. Door to Rocker Panel	1/8-1/4	–
7. Trunk lid to Fender	1/16-1/4	±1/16
8. Trunk lid to Bumper	5/16-7/16	–
9. Windows	5/16-3/8	*
10. Rear Bumper to Fender	1/2-3/4	–

*May be out of plane if weatherstrip provides watertight seal.

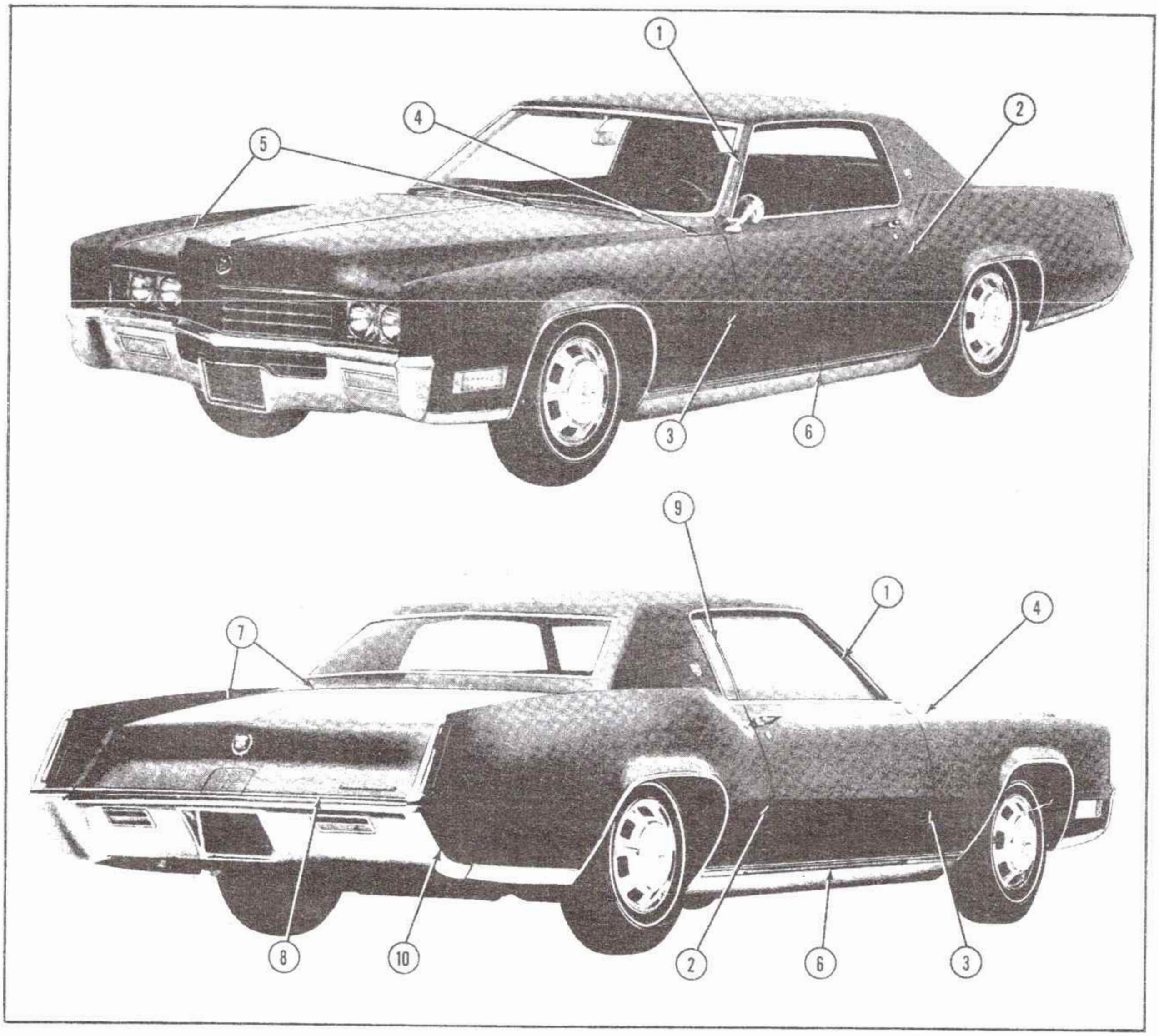


Fig. 11-12 Sheet Metal Tolerances

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
260M	Front Fender to Radiator Cradle	3/8-16	25
Special	Front Fender to Cowl	3/8-16	25
Special	Front Fender to Rocker Panel	3/8-16	25
Special	Front Fender to Hinge Pillar	3/8-16	25
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.			

TABLE OF CONTENTS

GENERAL DESCRIPTION

LIGHTING SYSTEM

The headlights are controlled by the headlight control switch, Fig. 12-1, located on the instrument panel at the left of the instrument panel cluster. This switch also controls parking lights, tail lights, interior lights, and license plate lights.

The headlights operate when the control switch knob is pulled all the way out. The parking lights, which are amber colored when illuminated, can be turned on by pulling the knob half-way out. The instrument panel lights can be turned on when the knob is in either position and their intensity can be varied from bright to off by rotating the knob to the right. The interior lights may be turned on by rotating the headlight control knob to the extreme left.

Cornering lights are mounted forward of the wheel opening on each front fender. When either turn signal is operating, with the headlights or parking lights on, the corresponding cornering light illuminates the side of the road. The cornering lights are designed so that no adjustment is necessary.

The lane-change directional signal switch is standard equipment on all steering columns. When making a partial turn, such as when changing lanes, the driver has the option of moving the turn signal lever to a detent stop. The signal will continue as long as the lever is held in this position and will cancel automatically when the lever is released. By using the detent position, a shallow turn can be signaled without a possibility of failure to cancel, if the turn is not sharp enough to do it automatically.

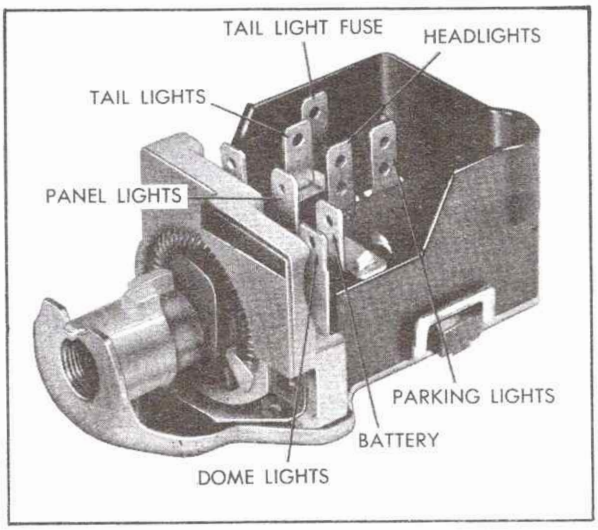


Fig. 12-1 Headlight Switch

Moving the turn signal lever past the detent position to the extreme of its travel for either turn, will provide conventional turn signal operation.

A Hazard Warning Flasher is included in the directional signal switch circuit as standard equipment. Pushing the switch control knob, Fig. 12-2, inward will energize the flasher regardless of ignition switch or turn signal switch position. Pulling the knob outward or turning the steering wheel will cancel the Hazard Warning Flasher.

When operating, the turn signal indicator lights and the front and rear turn signal lights will flash. This circuitry disconnects the regular turn signal flasher and substitutes another flasher. The Hazard Warning Flasher will operate with the ignition switch on or off. If the brake pedal is depressed while the Hazard Warning Flasher is operating, all lights will burn continuously. The flasher is located on the rear side of the steering column lower cover.

1. Headlight Aiming—Mechanical Aimer Method

a. Adjusting Aimer for Floor Level

NOTE: To obtain accurate headlight aim, the car must be placed on a flat surface.

1. Drive car on selected area and place transit target at rear wheel on either side of car, Fig. 12-3.

2. Place transit at front wheel on same side so target is visible, Fig. 12-3.

3. Adjust screw on back of transit until split image is aligned, Fig. 12-4.

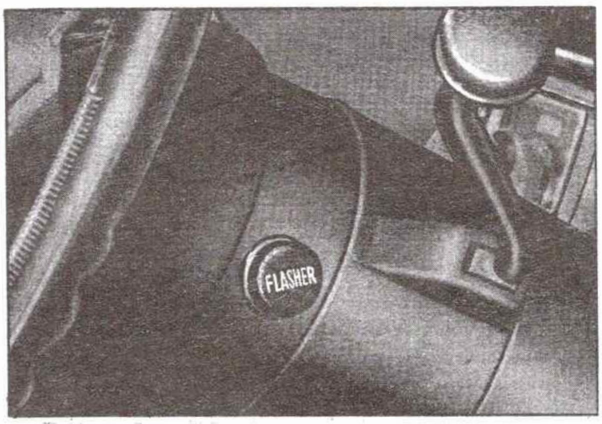


Fig. 12-2 Hazard Warning Flasher

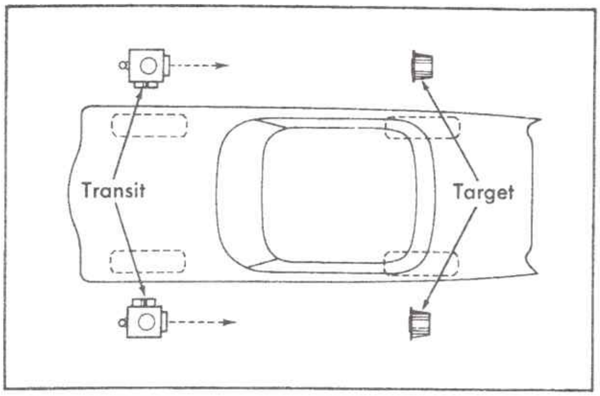


Fig. 12-3 Selecting an Aiming Area

4. Turn dial on side of transit until bubble is centered in level vial, Fig. 12-4.

5. Turn floor level compensator on both aimers with screwdriver until adjoining dial reads same as dial on transit, Fig. 12-5.

NOTE: Aimers must have floor level compensator readjusted for each new location if floor levels are different.

b. Headlight Adjustment

1. Equalize tire pressure as recommended in Section 10, Note 2, and make certain car is at normal front standing height: Section 3, Note 2,

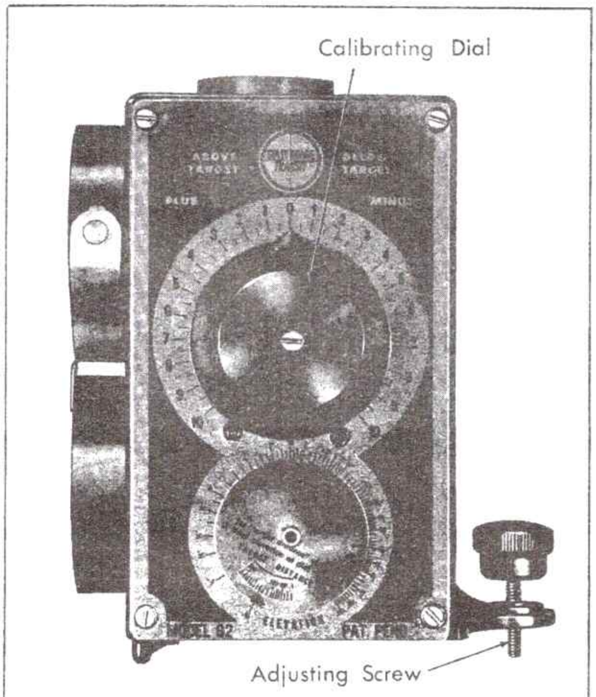


Fig. 12-4 Adjusting Transit

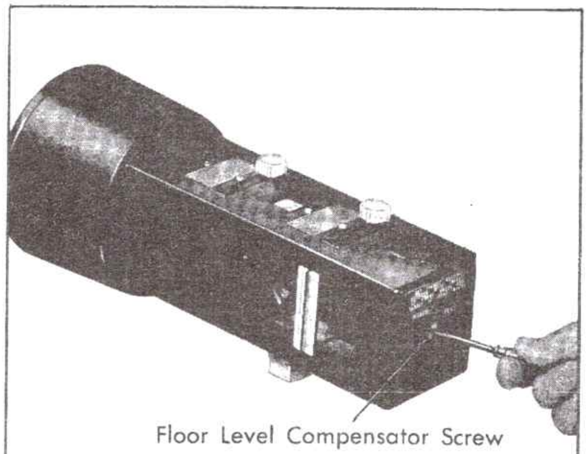


Fig. 12-5 Adjusting Floor Level Compensator

on all but 693 styles and Note 34 on 693 styles. Make certain car is at normal rear standing height, Section 4, Note 1.

2. Turn on headlight units to make sure none are burned out. All four units should be on for high beam and only the two upper units should be on for lower beams. Turn lights off for adjustment.

3. Remove headlight bezels exposing adjusting screws on all except 693 styles. On 693 styles turn headlights on.

4. Clean headlight lens. Position aimers on upper headlights on all but 693 styles. On 693 styles, position aimers on outer headlights. Guide points must engage smooth inner ring of aimer at alignment points, Fig. 12-6 and the "sight" openings on each aimer must point toward center of car.

5. Secure aimer to each headlight by pressing handle "Y" forward until vacuum cup engages headlight lens, then draw handle back until spring catches, Fig. 12-7.

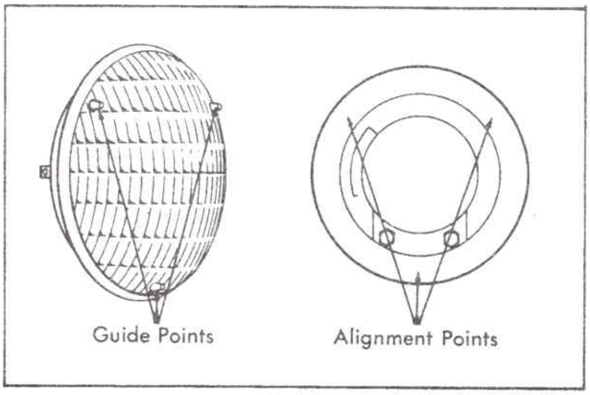


Fig. 12-6 Installing Aimers on Sealed Beams

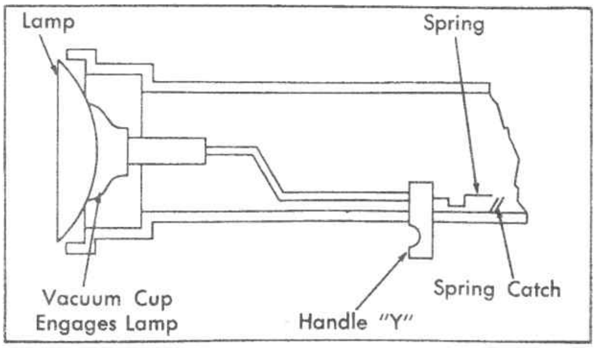


Fig. 12-7 Securing Aimers on Sealed Beams

c. Horizontal Headlight Aiming

1. Set "Right - Left" dial on zero, Fig. 12-8.

2. Check split image in viewing port. Rotate aimer slightly if necessary to locate target.

3. If split images are aligned, horizontal aim is correct.

4. If images are not aligned, turn horizontal adjusting screw until split images align. Final adjustment should be made by turning screw in a clockwise direction to remove backlash.

d. Vertical Headlight Aiming

1. With equipment in place turn knob at "Down-Up" dial until pointer is at "2" down.

NOTE: Individual State laws may vary and dealers should check with local authorities on the regulations of your State.

2. Turn headlights vertical aiming screw counterclockwise until bubble is on car side of center. Turn screw clockwise until bubble is centered for correct aim and elimination of backlash, Fig. 12-8. Repeat horizontal and vertical adjustments on other headlight aimer.

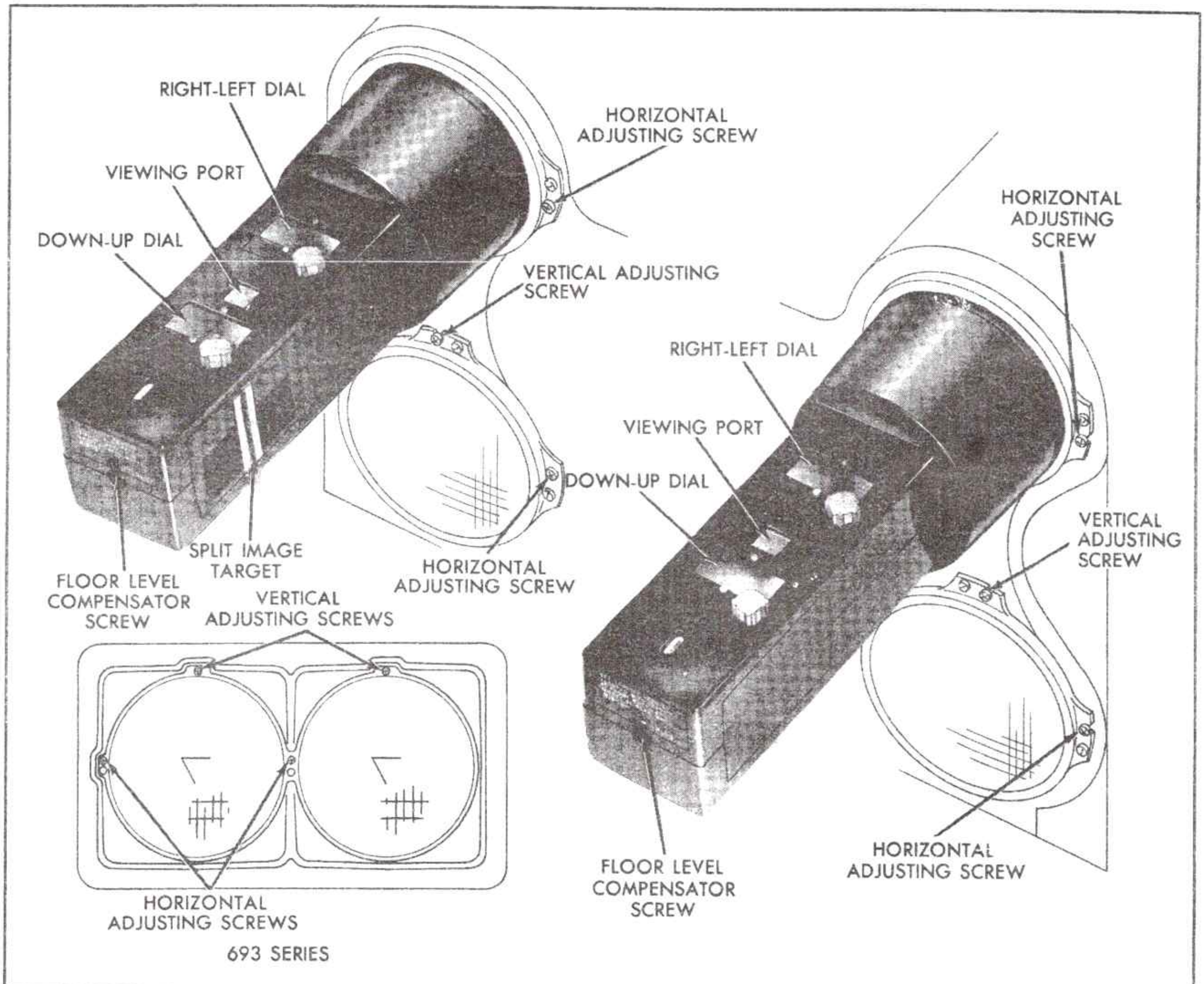


Fig. 12-8 Horizontal and Vertical Adjustments

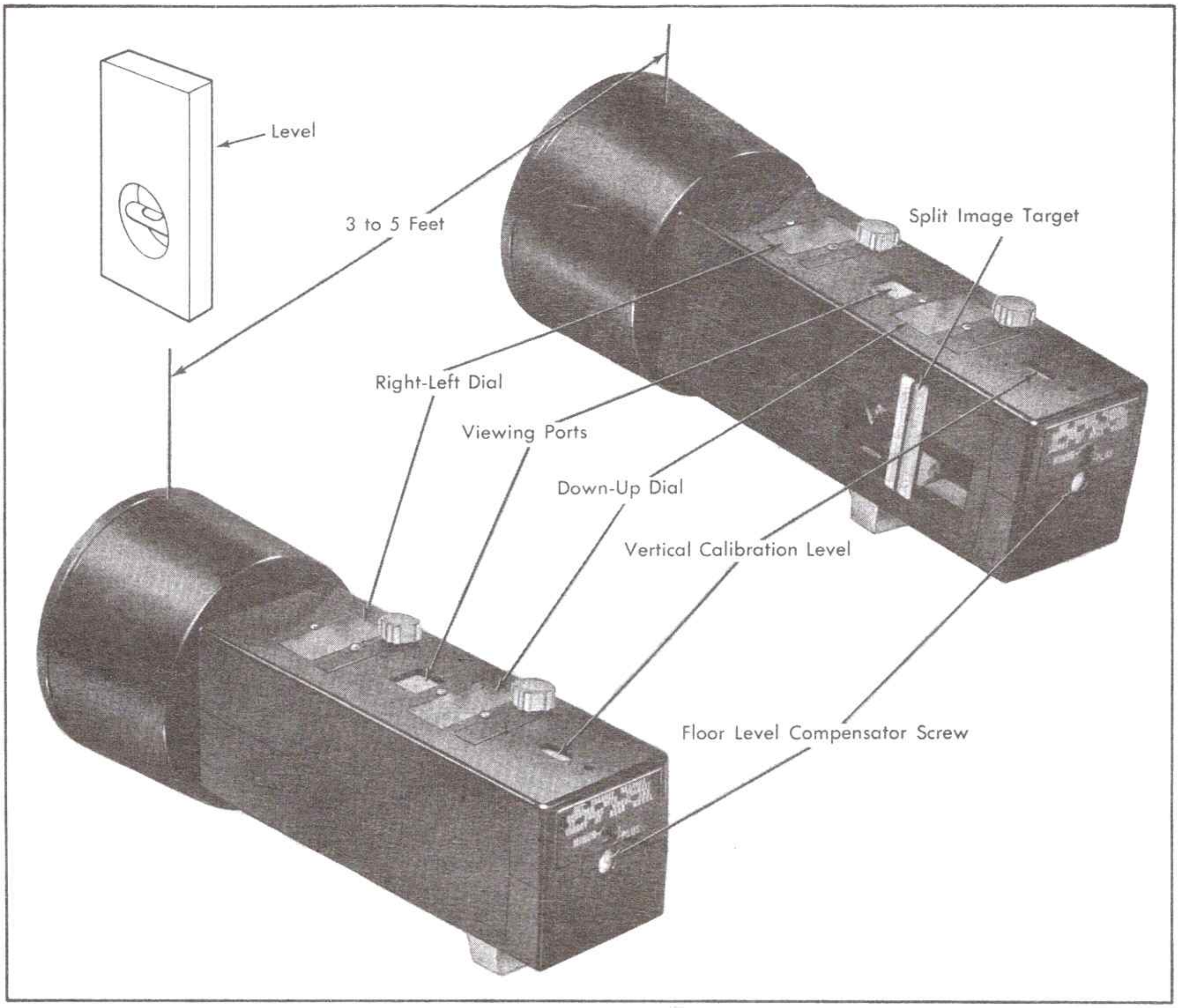


Fig. 12-9 Calibrating Headlight Aimer

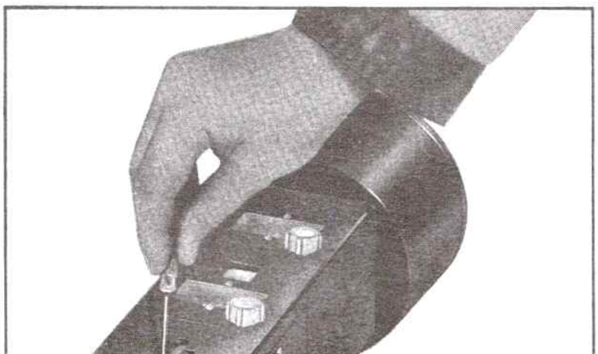


Fig. 12-10 Readjusting Vertical Calibrator

3. Recheck target alignment on each side and readjust horizontal aim if necessary.

4. Hold aimer and release spring catch, Fig. 12-7. Push handle toward headlight to release aimer.

5. Repeat horizontal and vertical adjustments on lower set of headlights on all but 693 styles. On 693 styles, position aimers on inner headlights.

e. Calibrating Aiming Fixture

Aimer, J-6663, is calibrated at the factory for use on a level floor. These aimers require no further change in factory calibration unless they are dropped or damaged in some manner.

1. With the aid of a good grade carpenter or

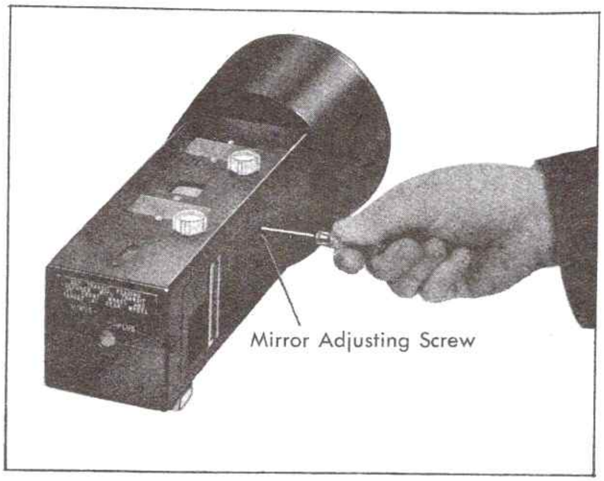


Fig. 12-11 Readjusting Horizontal Calibration

stone mason spirit level, locate a vertical plate glass window, Fig. 12-9.

2. Set "Down-Up" pointer on "2 down". Set "Right - Left" pointer and floor level compensator at "0".

3. Secure aimers to plate glass window 3 to 5 feet apart so split image targets can be located in the viewing ports.

4. If bubble is centered in vial, vertical calibration is correct. If not centered, refer to Section f of this note for adjustments.

f. Re-Adjusting Headlight Aimer

1. With equipment left in place, turn level adjusting screw until bubble is centered on level to obtain correct vertical adjustment, Fig. 12-10.

2. Turn mirror adjustment screw until target split image becomes aligned, Fig. 12-11.

2. Headlight Aiming—Screen Method (All Except 693)

The factory recommended headlight aiming specifications for the screen method are listed below. However, individual State laws may vary and dealers should check with local authorities.

a. Screen Diagram

Make a headlight aiming screen according to the dimensions and layout shown in Fig. 12-12.

b. Equipment Set-Up

Make sure headlight aiming screen is mounted at a point where there will be an ample level area in front of screen. It is important that floor at aiming screen is at same level as the floor at the point where car is positioned.

c. Headlight Aiming Adjustment

1. Position car so that headlights are exactly 25 feet from aiming screen and car is in line with centerline on screen. To position car, sight through rear window, lining up centerline of rear window reveal molding escutcheon with inside rear view mirror bracket and car centerline on screen.

2. Position two 36 inch sticks vertically at the left front and left rear wheels. Sight over sticks and move left side of screen up or down, as required, to line up horizontal upper headlight centerline on screen with the 36 inch sight line. Follow same procedure on right side.

3. Mark wall adjacent to horizontal centerline of upper headlight line on aiming screen. Subtract the curb height from 36. Using the new dimension mark down on wall from the 36 inch mark.

BODY SERIES	TIRE SIZE	CURB HEIGHT
680, 681	9.00	31-3/4"
682, 683	9.00	31-5/16"
697	8.20	32-1/2"
698	8.90	33-5/16"

Move screen down until horizontal centerline of upper headlight is even with this point.

4. Remove headlight bezels.

5. Set headlights on high beam. Make sure all four headlights are on.

6. Cover both left side headlights and right side upper light and adjust right lower light as required until hot spot centers at point "A" on screen, Fig. 12-12.

7. Cover both right side headlights and left side upper light and adjust left lower light as required until hot spot centers at point "B" on screen, Fig. 12-12.

8. Set headlights on low beam. Only upper headlights should light.

9. Cover left upper headlight and adjust right upper light as required until top of hot spot "C" is on horizontal centerline of headlight and left edge of hot spot is on vertical centerline of upper light, Fig. 12-12.

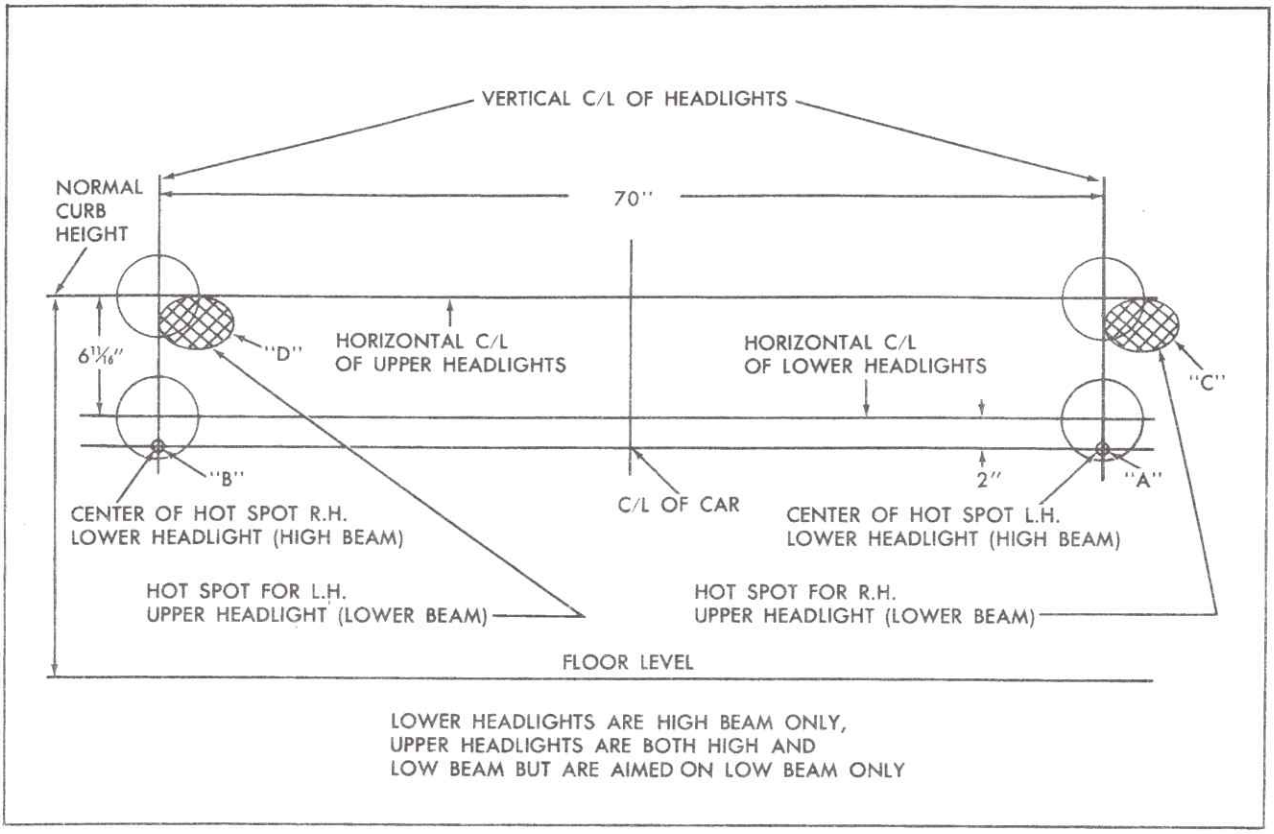


Fig. 12-12 Headlight Aiming Screen

10. Cover right upper headlight and adjust left upper light as required until top of hot spot "D" is on horizontal centerline of headlight and left edge of hot spot is on vertical centerline of upper light, Fig. 12-12.

11. Install headlight bezels.

3. Sealed Beam Unit Replacement (All Except 693)

1. Remove three screws that hold headlight bezel to headlight housing and remove bezel.

2. Disconnect retaining spring from retaining ring and slide sealed beam assembly off adjusting screws.

3. Disconnect three-way electrical connector from sealed beam unit.

4. Remove two screws that hold retaining ring to mounting ring and separate mounting ring from sealed beam unit.

5. Remove retaining ring from sealed beam unit.

6. Install new sealed beam unit in retaining ring.

7. Install ring with sealed beam unit on mounting ring and secure with two attaching screws.

8. Connect multiple connector to sealed beam unit.

9. Install sealed beam assembly on adjusting screws and connect retaining spring to retaining ring.

10. Install headlight bezel on housing and secure with three attaching screws.

11. Aim headlights as described in Note 1 or 2.

4. Bulb Replacement

A complete list of replacement bulbs for 1967 Cadillac cars is given in the bulb chart, page 12-78. The procedures for making replacements are outlined in this note except where they are exclusive to the Fleetwood Eldorado. Those procedures are described in Note 74.

CAUTION: Make certain ignition switch is off when replacing bulbs.

a. Turn Signal Indicator Lights (All Except 693)

1. Remove three screws that hold headlight bezel to headlight housing and remove bezel.

2. Remove four screws that secure headlight housing to fender and position housing to one side.

3. Remove nut that secures black ground wire and bracket.

4. Pull bracket and lamp assembly down and remove through headlight opening.

5. Remove screw that secures lamp assembly to bracket.

6. Remove screw that secures lamp lens and gasket to housing.

7. Replace bulb.

8. With gasket positioned correctly, install lens in housing and secure with one screw.

9. Position lamp assembly on bracket and secure with one screw.

10. Working through headlight opening, position bracket and lamp assembly on front bezel stud.

11. Position black ground wire on front stud and secure with nut.

12. Install headlight housing on fender with four screws.

13. Install headlight bezel on housing with three screws.

b. Front Turn Signal and Parking Lights (All Except 693)

1. Remove front turn signal and parking light assembly as described in Note 6a on standard cars.

2. Remove two nuts securing housing to assembly.

CAUTION: Be careful not to drop lens or ornament as they are now loose.

3. Replace bulb.

4. Position ornament and secure housing with two attaching nuts.

5. Install front turn signal and parking light assembly as described in Note 6b.

c. Rear Back-Up, Tail, Stop and Signal Lamp Bulbs (All Except 693)

1. Remove two Phillips head screws securing bezel and lens to housing.

2. Replace bulb being careful not to dislodge filters.

3. Position lens and bezel and secure with two Phillips head screws.

d. License Bulb (All Except 693)

1. Remove two screws securing license lamp lens and remove lens.

2. Replace bulb.

3. Install license lamp lens and secure with two screws.

e. Instrument Panel Courtesy Lights

1. Remove two screws that hold lens and housing to lower instrument panel.

2. Remove lens and housing and replace bulb.

3. Snap socket from housing and change bulb.

4. Install lens and housing on lower instrument panel and secure with two attaching screws.

f. Windshield Wiper Switch Control Light

Remove steering column lower cover as described in Note 38a to gain access to bulb.

g. Automatic Climate Control Panel Light (Upper)

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove socket from housing, replace bulb and install socket.

3. Install upper instrument panel cover as described in Note 37b.

h. Automatic Climate Control Panel Light (Lower)

1. Remove steering column lower cover as described in Note 38a.

2. Remove socket from housing and replace bulb and install socket.

3. Install steering column lower cover as described in Note 38b.

i. Ignition Switch Light

Remove ignition switch as described in Note 49a to gain access to bulb.

j. Radio Dial Light

Remove bulb socket from top center of receiver unit by working beneath instrument panel.

k. Headlight Switch Dial Light (Upper)

1. Remove fuse panel as described in Note 36.

2. Disconnect upper dial bulb socket and replace bulb and socket.

3. Install fuse panel as described in Note 36.

l. Headlight Switch Dial Light (Lower)

1. Remove steering column lower cover as described in Note 38a.

2. Remove upper dial bulb socket and replace bulb and socket.

3. Install steering column lower cover as described in Note 38b.

m. Ash Tray Light

1. Remove either ash tray receptacle.

2. Remove bulb socket from shield, replace bulb and install socket.

3. Insert ash tray receptacle.

n. Glove Box Light

Open glove box door and replace glove box bulb located just above top center of door opening.

o. Cruise Control Selector Dial Light

1. Loosen set screw with 5/64 inch Allen wrench and remove switch lever knob.

2. Remove nut, lock washer, flat washer, wave washer and selector dial.

3. Remove screw securing bulb shield to speed selector assembly.

4. Remove bulb socket from bulb shield and replace bulb.

5. Install bulb socket into bulb shield.

6. Position bulb shield on speed selector assembly and secure with one screw.

7. Install selector dial, wave washer, flat washer, lock washer and nut.

8. Install switch lever knob so that flat on knob aligns with flat on shaft and tighten set screw with 5/64 inch Allen wrench.

p. Cornering Lights

1. Remove cornering light assembly as described in Note 8a.

2. Remove four screws securing bezel to housing.

3. Remove lens from lamp and replace bulb.

4. Install lens with gasket in place.

5. Install four screws securing bezel to housing.

6. Install cornering lamp as described in Note 8b.

q. Seat Warmer Tell Tale Bulb (697 Styles Only)

1. Disconnect negative battery cable at battery.

2. On cars equipped with Tilt and Telescope steering wheel, position wheel in maximum UP position for greater accessibility.

3. Remove two Phillips head screws that hold lower end of steering column lower cover to lower instrument panel.

4. Carefully disengage steering column lower cover by pulling out to disengage two upper pins on cover to gain access to seat warmer tell tale bulb.

5. Disengage tell tale socket from lower cover and replace bulb.

6. Position spring and ground washer on socket and install into steering column lower cover.

7. Install steering column lower cover so that two upper pins engage lower instrument panel.

8. Install two Phillips head screws that hold lower end of steering column lower cover to lower instrument panel.

9. Connect negative battery cable at battery.

5. Instrument Panel Lights

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove socket and replace map light bulb if it is burned out.

3. All other bulbs are wedge base bulbs operating off the printed circuit.

4. Install upper instrument panel cover as described in Note 37b.

6. Front Turn Signal and Parking Light Assembly (All Except 693)

a. Removal

1. If removing left lamp, disconnect negative battery cable.

2. If removing right lamp, remove battery as described in Section 6, Note 16a.

3. Pull wiring connector apart.

4. Remove two nuts that secure light assembly to front grille and pull assembly out.

b. Installation

1. Position assembly on grille. Connect wiring connector.

2. Secure assembly to front grille with two attaching nuts.

3. If right lamp was removed, install battery as described in Section 6, Note 16b.

4. If left lamp was removed, connect negative battery cable.

7. Rear Back-Up, Tail, Stop and Signal Lamp Assembly (All Except 693)

a. Removal

1. Remove rear bumper as described in Section 14, Note 6a.

2. Remove two nuts securing assembly to end bar and remove from end bar.

b. Disassembly

1. Remove two Phillips head screws securing bezel and lens to housing.

2. Remove three bulbs.

3. Remove gasket.

4. Remove two red filters.

5. Remove one Phillips head screw securing clear reflector to housing and remove reflector.

c. Assembly

1. Position clear reflector on housing and secure with one Phillips head screw.

2. Install gasket.

3. Install one red filter so that one end seats in housing and other on gasket. Repeat with other red filter.

4. Install all three bulbs.

5. Position lens and bezel on housing and secure with two Phillips head screws.

d. Installation

1. Position assembly in end bar and secure with two nuts.

2. Install rear bumper as described in Section 14, Note 6b.

8. Cornering Light Assembly

a. Removal

1. Remove clip, screw and flatwasher securing rubber mat to fender.

2. Remove three screws and flatwasher securing fender brace and remove brace.

3. Disconnect lead connector from cornering lamp.

4. Remove two screws and flatwashers that secure rear of cornering lamp to fender.

5. Remove one screw and flatwasher that secures front of cornering lamp to fender and remove cornering lamp.

b. Installation

1. Install cornering lamp in fender and secure rear of cornering lamp with two screws and flatwashers.

2. Install one screw and flatwasher that secures front of cornering lamp to fender.

3. Connect lead connector at cornering lamp.

4. Install fender brace with three screws and flatwashers.

5. Secure rubber mat to fender with clip, screw and flatwasher.

9. License Lamp Assembly (All Except 693)

a. Removal

1. Disconnect brown license lamp wire connector.

2. Remove two Phillips head screws securing license lamp bracket to center bar and remove housing with bracket attached.

b. Installation

1. Position housing with bracket attached in center bar and secure with two Phillips head screws.

2. Connect brown wire connector.

GENERAL DESCRIPTION

ELECTRICAL INSTRUMENTS

The air-core type fuel and temperature gages are mounted in a housing at the right and left sides of the transmission shift indicator in the instrument panel cluster. The gages use balanced needle construction, which means that when the ignition is turned "OFF", the pointer may come to rest at any point.

The instrument panel cluster has five tell-tale lights on the left side. From top to bottom these are: Cruise Control, trunk, brakes, oil and generator.

On cars equipped with Cruise Control, the word "CRUISE" will light green when the unit is set for automatic control. The red trunk light will come on whenever the trunk lid is unlocked on cars equipped with Remote Control Trunk Lid.

The red brake warning light will light whenever brake pedal travel exceeds a predetermined amount. The red oil or generator lights come on when oil pressure is low or the generator is not charging.

The high beam indicator light is located just below the sixty mile per hour mark on the speedometer dial face.

The speedometer and odometers are driven by a gear train in the speedometer housing, which is driven through a flexible shaft that is connected to the transmission. The flexible shaft is driven at the transmission by an output gear designed especially for the vehicle, and takes into consideration such variables as tire size and differential ratio.

The odometer portion, which indicates distance traveled, is divided into two sections - the left half (season odometer) records accumulated mileage and the right half indicates trip mileage. A reset knob for the trip odometer is located in the instrument cluster. Push in fully and turn to reset. No attempt should be made to reset the season odometer.

The turn signal indicators are located at the forward end of the front fender crown moldings.

Twin solenoid-type horns, matched in tone, are located on the center of the radiator cradle assembly directly behind the radiator grille. A third short trumpet solenoid-type horn is located on the left side of the radiator cradle assembly. On all cars, a low "D" note horn may be installed as optional equipment. The horn relay is located on the left rear side of the radiator cradle baffle plate. It is actuated by depressing the horn buttons on the steering wheel.

The clock assembly is located on the right side in the instrument panel cluster. It is spring driven movement, which is electrically wound. The clock winds every two and one-half or three minutes, but draws current for only a fraction of a second each time it winds.

The electrical instruments portion of this section covers disassembly, assembly and testing procedures of serviceable instrument panel components. Procedures for removal and installation of electrical instruments that may be considered a part of or attached to the instrument panel are in the Instrument Panel portion of this section.

The electrical circuit diagram for instruments and the diagram for external lighting and horns for all cars except the Fleetwood Eldorado are illustrated in Figs. 12-13 and 12-14 respectively.

10. Fuel Gage Service

When checking the fuel gage circuit, first determine whether the tank unit, wiring, or fuel gage is faulty. Perform the following tests to find the trouble.

a. Ignition On—Gage Does Not Register

1. Turn the ignition switch on. Fuel gage should register. If it does not proceed to step 2 and continue until defective component is isolated.

2. If fuel gage, oil pressure light, generator tell-tale and temperature gage fail to register, the fault may be an open in the 18 pink wire to the printed circuit, part b of Note 17.

3. Check fuel gage dash unit as described in part e of this note.

4. Check for an open printed circuit (#12 circuit), part e of Note 17.

b. Ignition On—Gage Registers Full Under All Conditions

1. Turn ignition switch on. If gage registers full under all conditions, proceed to step 2 and continue until defective component is isolated.

2. Check for a defective tank unit or poor ground as described in part d of this note.

3. Check for open 18 tan wire from printed circuit to tank unit as described in part c of Note 17.

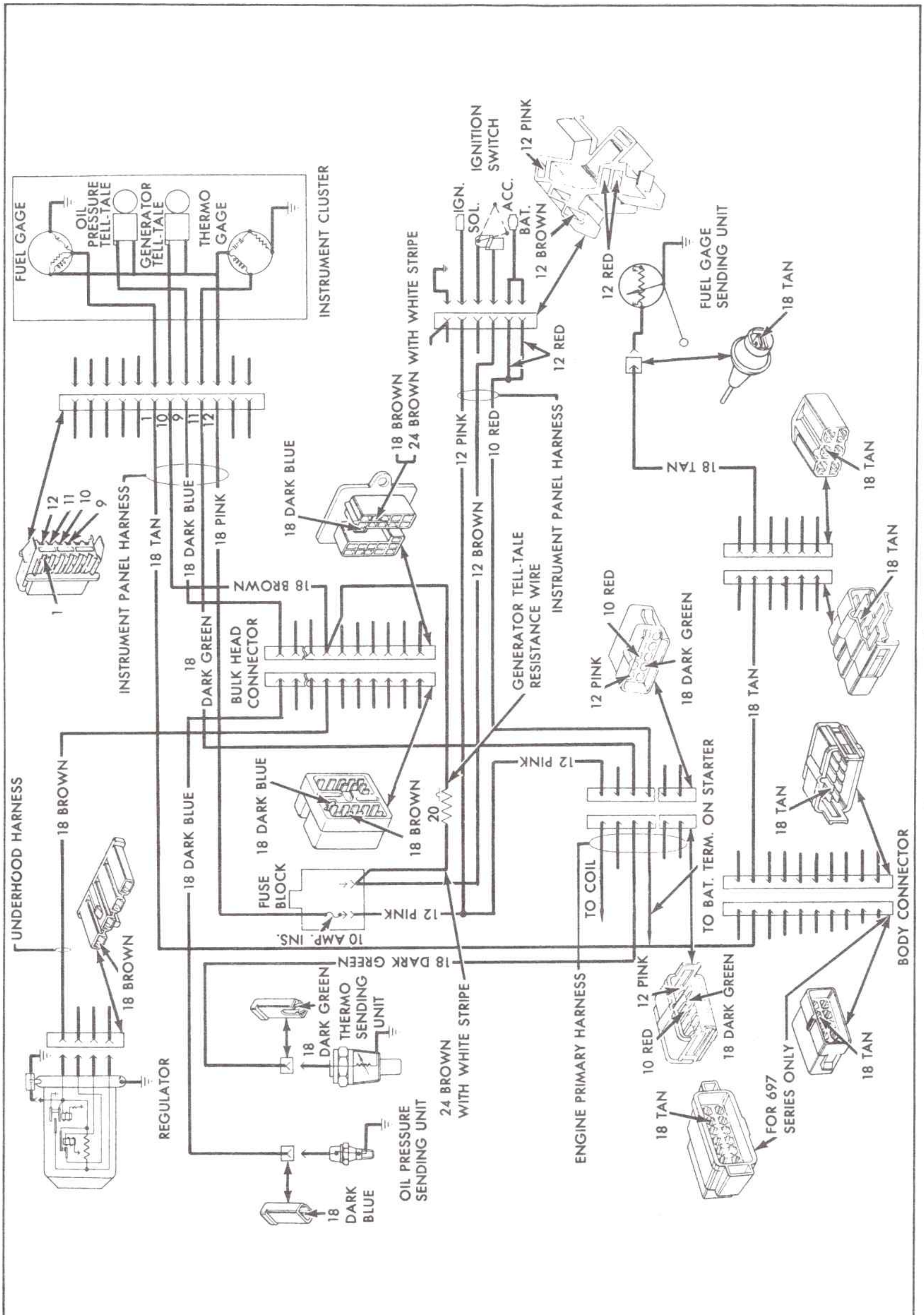


Fig. 12-13 Instruments - All Except 693 Styles

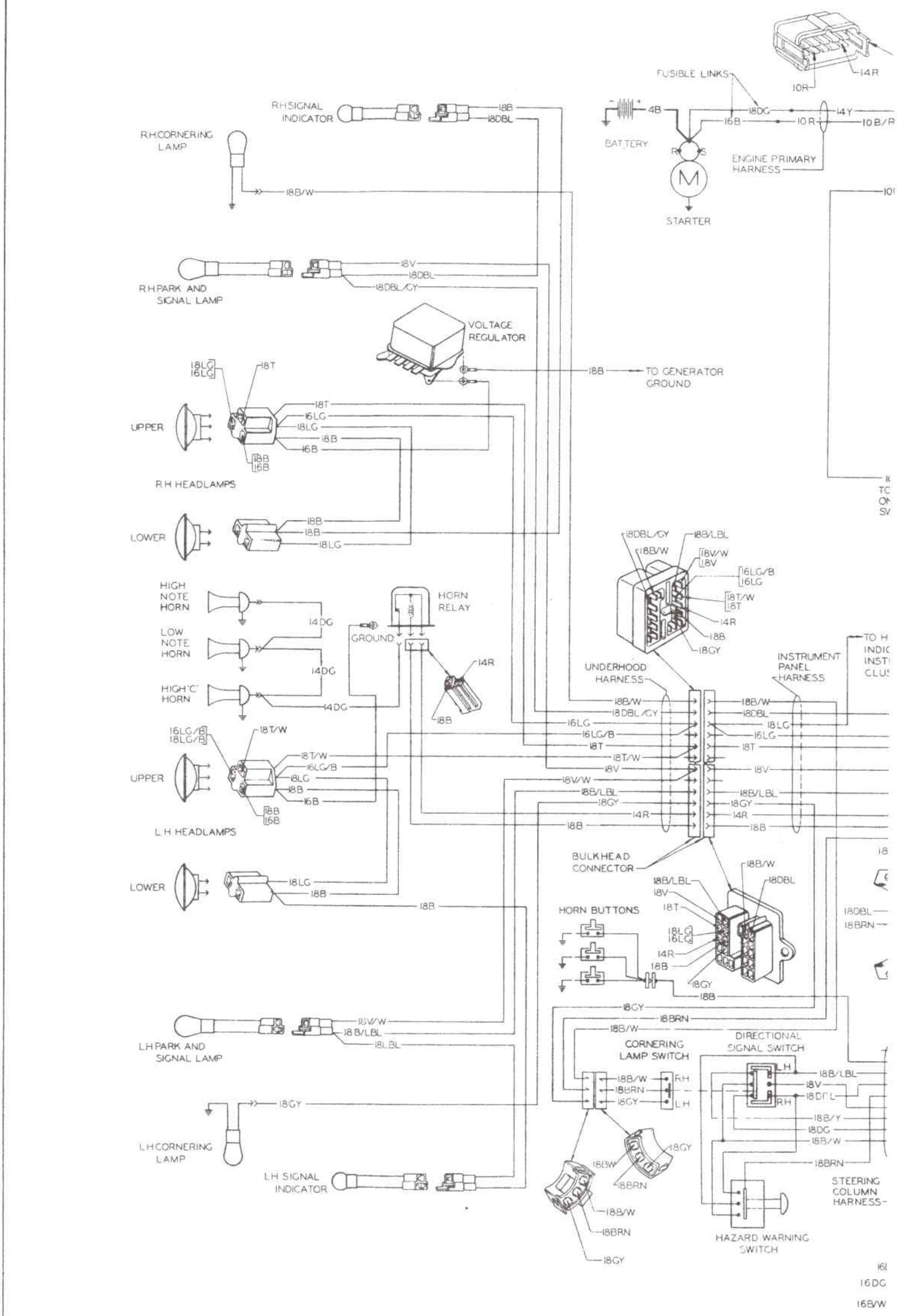


Fig. 12-14 External Lighting and Horns - All Except 693 Styles

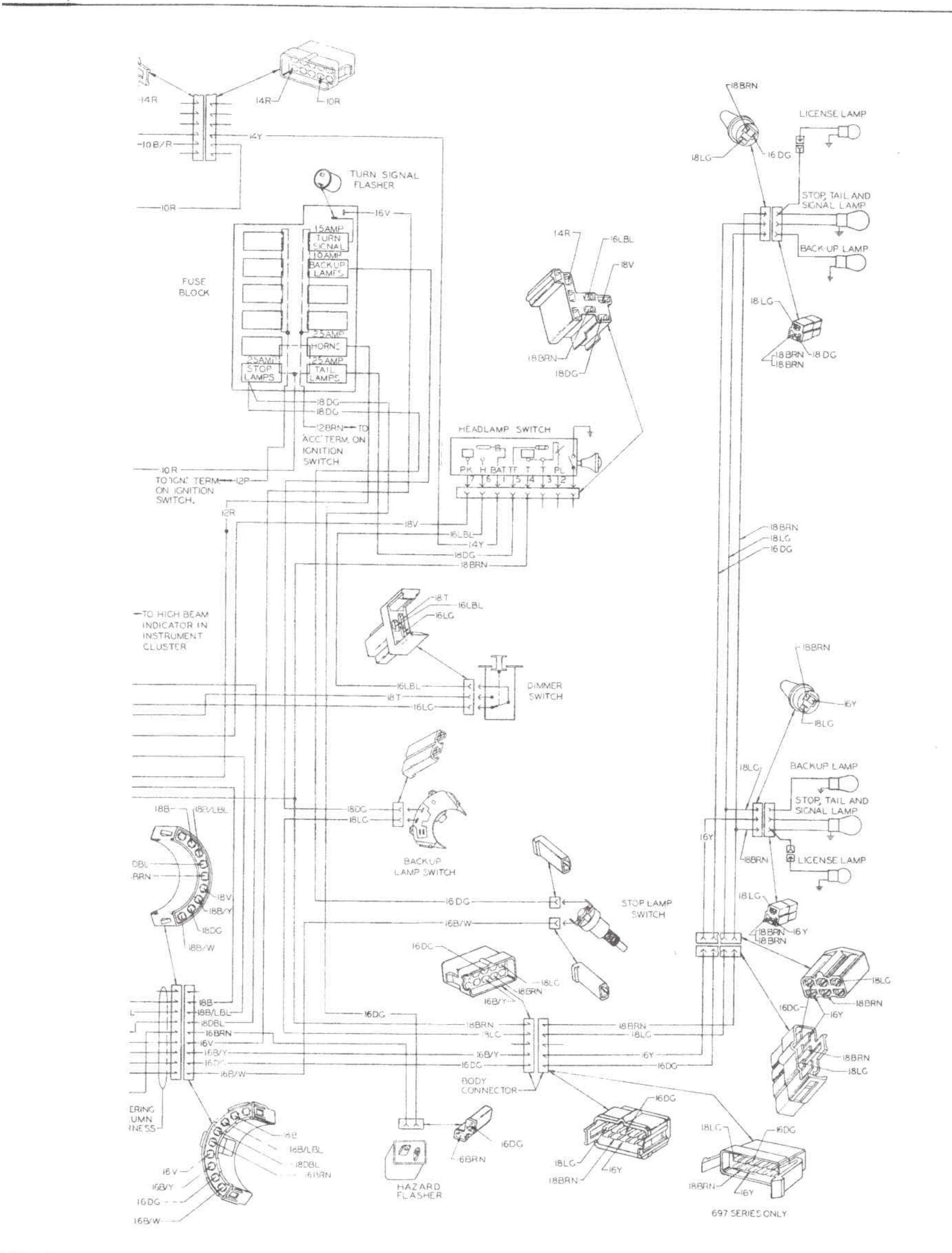


Fig. 12-14 External Lighting and Horns - All Except 693 Styles

4. Check for an open printed circuit (#1 circuit), part e, Note 17.

c. Ignition On—Gage Registers Empty Under All Conditions

1. Turn ignition switch on. If gage registers empty under all conditions, proceed to step 2 and continue until defective component is isolated.

2. Check for a grounded tank unit rheostat as described in part d of this note.

3. Check for a defective or poorly grounded dash unit as described in part e of this note.

4. Check for a short to ground in the 18 tan wire from the printed circuit to the tank unit as described in part d of Note 17.

5. Check for a short to ground in the printed circuit (#1 circuit) as described in Note 17, part e.

d. Checking Fuel Gage Tank Unit

CAUTION: Make certain the headlight switch is off when performing this test as accidentally grounding the lamp circuit wire inside the connector with a jumper lead may open the headlight switch circuit breaker.

NOTE: Make certain 12-way connector at instrument panel is connected, if previously disconnected.

1. Disconnect printed circuit to tank unit tan wire at connector inside license plate mounting door. On 693 styles, disconnect tan wire just inside trunk compartment.

2. Turn ignition switch on.

3. With wire disconnected, the dash unit pointer should read above the "full" mark. Then connect a jumper to the connector and ground the printed circuit to tank unit wire. The dash unit should read below the "empty" mark.

4. If system performs properly during this test and fuel gage fails to register when connected, the tank unit is defective.

5. If tank unit is found to be defective by this test, first check for a good ground. Make sure that mounting screws are tight, or on 693 style, that ground wire is securely welded to tank unit cam lock. Ground lead from tank unit should also be in good condition. Check to see that ground wire is securely attached to frame at the rear of tank for standard series, and securely attached to body structure in front of the tank of 693 style. If either tank unit is burned out, or tank unit rheostat is grounded, replace tank unit.

e. Fuel Gage Dash Unit Check

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove protective cover from fuel gage, using care not to damage printed circuit.

3. Disconnect multiple connector at instrument panel cluster case.

4. Using an 18 gage jumper wire, connect one end to battery terminal of starter motor solenoid and other to cluster gage unit stud that is closest to left fender. Fuel gage should read full.

CAUTION: Make sure that multiple connector is not connected. Under no circumstance should a hot lead be connected to terminal on dash unit that leads to tank unit with multiple connector attached. If the tank unit is connected to battery in any manner, tank unit will be burned out because resistance of the dash unit is by-passed.

5. Using a second jumper wire, ground remaining right hand stud on fuel gage. Gage should now read empty. If gage does not perform as described in steps 4 and 5, it should be replaced.

f. Bent Float Arm Check

If the above checks indicate the float unit is at fault, the float arm should be checked for a bent condition before replacing either unit. Check as follows:

1. Establish a fixed reference point when checking for a bent float arm by placing a straight

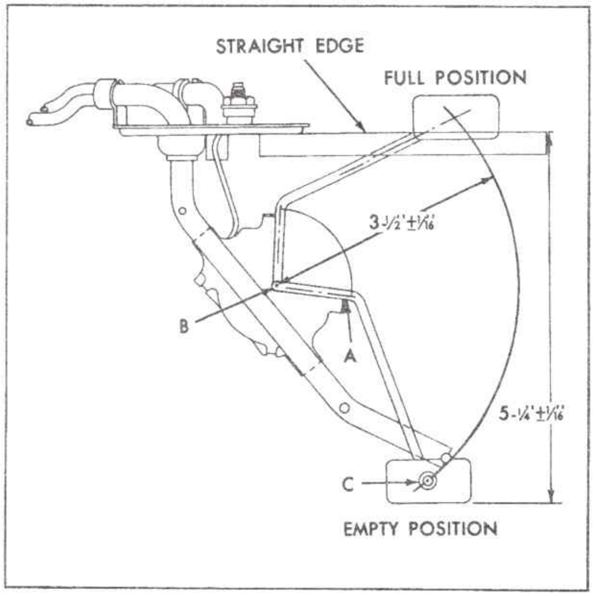


Fig. 12-15 Checking for Bent Float Arm - All Except 693 Styles

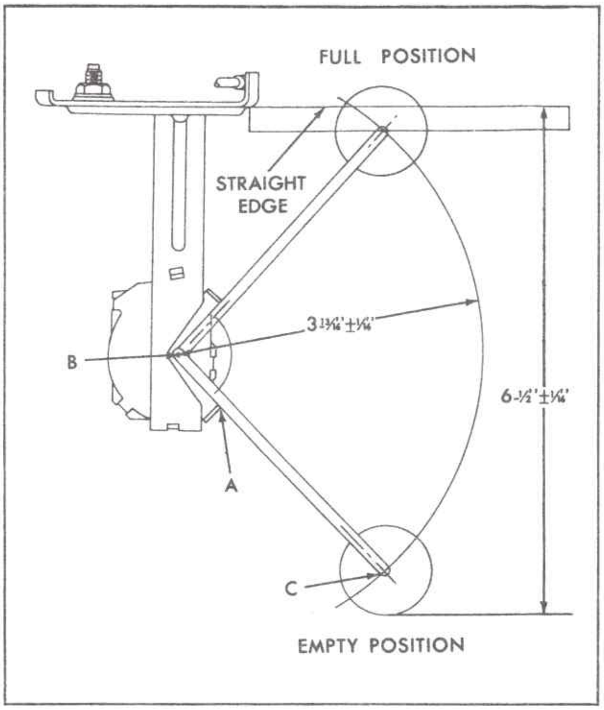


Fig. 12-16 Checking for Bent Float Arm - 693 Style

edge as illustrated on surface of cover plate, extending it outward. See Fig. 12-15 for all but 693 style or Fig. 12-16 for 693 style.

2. On all but 693 style, with float arm in "Empty" position against stop "A", distance from bottom of float (with float horizontal) to straight edge should be 5-1/4 inches ± 1/16 inch, Fig. 12-15. Bend float arm as needed. Check distance from point "B" to "C", which should be 3-1/2 inches ± 1/16 inch, Fig. 12-15. Bend float arm as needed and recheck distance from bottom of float to straight edge.

3. On 693 style, with float arm in "Empty" position against stop "A", distance from bottom of float to straight edge should be 6-1/2 inches ± 1/16 inch, Fig. 12-16. Bend float arm as needed. Check distance from point "B" to "C" which should be 3-13/16 inches ± 1/16 inch, Fig. 12-16. Bend float arm as needed and recheck distance from bottom of float to straight edge.

4. Check for a binding condition of float arm. On all but 693 style, make certain that float arm is not touching filter.

11. Fuel Gage Tank Unit (All Except 693)

a. Removal

1. Remove fuel tank as described in Section 8, Note 2a.

2. Remove locknut securing fuel gage tank unit wire to tank unit and remove wire from tank unit.

3. Remove five screws and six washers securing gage tank unit to tank and lift unit out of tank. Discard gasket.

4. Remove fuel strainer from gage tank unit and replace if necessary.

b. Installation

1. Install fuel strainer on gage tank unit.

2. Install gage tank unit in fuel tank, using new gasket, and install four mounting screws and washers at all holes except ground. At ground screw hole, position washer, ground wire and second washer, securing with screw.

3. Connect fuel gage wire to gage tank unit and secure with attaching locknut.

4. Install fuel tank as described in Section 8, Note 2b.

12. High Beam Indicator Circuit

When checking high beam indicator circuit, determine whether bulb, wiring or dimmer switch is defective. Perform the following tests as indicated to find the trouble.

1. Turn headlights on and, on cars equipped with Guide-Matic, rotate time delay and master on-off control lever to OFF. If high beam indicator light does not glow, depress foot switch. If high beam indicator light still does not glow, proceed to step 2 and continue until defective component is isolated.

2. Check for a burned out indicator bulb as described in part a of Note 17.

3. Check instrument panel feed circuit (18 light green wire) as described in part b of Note 17.

4. If step 3 does not check satisfactorily, remove foot switch connector and touch one lead of a test lamp that is not self powered to 16 light blue wire and ground other lead. Lamp should light. If it does not light, proceed to step 5. If it does light, dimmer switch or light green wire to printed circuit is defective. Replace dimmer switch on a trial basis. If the problem is not in dimmer switch, the 18 light green wire is open.

5. Using a test lamp that is not self powered, probe 16 light blue wire at headlight switch, and ground other lead. Lamp should light. If it does, open is in 16 light blue wire between headlight switch and dimmer switch.

6. Probe 14 red wire at headlight switch with one test lamp lead of a test lamp (not self-powered) and ground other lead. Lamp should

light. If it does light, headlight switch should be replaced. If lamp does not light, trouble is in wiring from headlight switch to positive battery terminal. Begin at No. 1 terminal connection of headlight switch and check continuity of circuit.

13. Trunk Lid Circuit

When checking trunk lid circuit, determine whether trunk lid switch, bulb, wiring or printed circuit is defective. Perform the following test to isolate the condition.

a. Trunk Lid Open

1. With trunk lid open, trunk lid bulb in instrument panel should glow. If it does not, proceed to step 2 and continue until defective component is isolated.

2. Disconnect wire connector at trunk lid and use a paper clip to ground the wire connector. If bulb lights, but did not light in step 1, the switch must be replaced.

3. Check for a burned out indicator bulb as described in part a of Note 17.

4. Check 18 orange wire to the printed circuit as described in part b of Note 17. An open in this wire will also cause clock to be inoperative.

5. Check 18 dark green with white stripe wire for an open as described in part c of Note 17.

6. Check 18 dark green wire with white stripe for a short as described in part d of Note 17.

7. Check printed circuit (Circuit #7 and #6) for an open as described in part e of Note 17.

14. Low Brake Indicator Switch Adjustment

NOTE: The low brake indicator switch and Cruise Control switch are combined on all cars, even if the car is not equipped with Cruise Control. Once the Cruise Control position of the switch is adjusted, as described below, the low brake indicator switch will be adjusted. The only exception to this design is on 693 styles equipped with disc brakes. The low brake indicator switch on these cars is in line with the brake line and cannot be adjusted. If defective, it must be replaced. If car is equipped with Cruise Control, see Section 15, Note 20.

1. Loosen mounting screw securing switch to brake pedal mounting bracket.

2. Connect a self-powered test lamp such as Diode Tester, J-21008, to the two bare terminals on the switch. Adjust switch so that lamp will light when brake pedal is fully released and will go out when brake pedal is depressed approximately 1/2 inch. Tighten switch mounting screw.

3. If switch cannot be adjusted, it is defective and should be replaced.

4. If necessary to install new switch, repeat steps 1 and 2.

5. Remove test lamp.

6. If an inoperative low brake indicator circuit is suspected, the bulb and wiring may be checked as outlined in Note 17, parts a through e. If a defective switch is suspected, and all other checks are all right, remove low brake indicator switch. With wiring attached and switch grounded, manually move lever on switch to see that switch makes and breaks circuit as indicated by tell-tale bulb in instrument panel.

15. Oil Pressure Indicator Service

The oil pressure indicator light is connected in a circuit with the ignition switch and a pressure operated switch threaded into the oil header galley at rear of engine. Indicator light warns driver when oil pressure is below 4 pounds ± 1-1/2 pounds.

If light does not come on when the ignition switch is turned on, or if light stays on after engine is started and run for 30 seconds, either pressure is low or one of the following units is defective: wiring, bulb, printed circuit, or oil pressure switch. Check as outlined below.

a. Ignition On—Engine Not Running

1. Turn ignition switch on but do not start engine. Oil indicator light should glow. If it does not, proceed to step 2 and continue until defective component is isolated.

2. If oil pressure light, fuel gage, generator tell tale and temperature gage fail to register, fault is probably an open in 18 pink wire to printed circuit, part b of Note 17.

3. Check operation of oil sender switch as described in part c of this note.

4. Check condition of tell-tale bulb as described in part a of Note 17.

5. Check condition of 18 dark blue wire from printed circuit to oil pressure switch as described in part c of Note 17.

6. Check condition of printed circuit as described in part e of Note 17.

b. Engine Running

1. Start engine and run for 30 seconds. Oil pressure indicator light should not glow. If it

does, proceed to step 2 and continue until defective component is isolated.

2. Check operation of oil sender switch as described in part c of this note.

3. Check 18 dark blue wire for a short to ground as described in Note 17, part d. Repair or replace as necessary.

4. Check for a defective printed circuit (#9 circuit) as described in Note 17, part e.

c. Oil Pressure Switch Check

1. Disconnect dark blue wire at oil pressure switch.

2. Turn ignition switch to ON position but do not start engine.

3. Connect a test lamp consisting of a one-candle power bulb and a pair of test leads in circuit by clipping one lead to battery terminal of starter solenoid and other lead to terminal of oil sender switch. Test bulb should light; if it does not, oil pressure switch is open and should be replaced.

NOTE: Sealing compound on threads of switch may cause this condition and should never be used.

4. Start engine and run for 30 seconds. Test lamp should not light. If it does, the oil pressure switch is shorted or the oil pressure is low. Replace switch on a trial basis. If new switch does not correct condition, remove switch and test pressure with a reliable pressure gage. Repair as necessary.

16. Temperature Gage Service

When checking the temperature gage circuit, determine whether engine thermogage unit, wiring, dash unit or printed circuit is faulty. Perform following tests to isolate trouble.

a. Ignition On—Gage Does Not Register

1. Turn ignition switch on. Temperature gage should register when engine has been warmed up. If it does not, proceed to step 2 and continue until defective component is isolated.

2. If temperature gage, oil pressure light, fuel gage and generator tell-tale fail to register with ignition switch on, check for an open 18 pink wire to the printed circuit, part b of Note 17.

3. Check for a defective thermogage unit as described in part d of this note.

4. Check for a defective temperature gage as described in part e of this note.

5. Check for an open in the printed circuit (#12 circuit), part e of Note 17.

b. Ignition On—Gage Registers High Temperature Under All Conditions

1. Turn ignition switch on. If gage registers high temperature under all conditions, proceed to step 2 and continue until defective component is isolated.

2. Check thermogage unit as described in part d of this note.

3. Check for a poor dash unit ground or defective dash unit as described in part e of this note.

4. Check for a shorted condition in 18 dark green wire as described in part d of Note 17. Locate short and repair.

5. Check for a shorted printed circuit (#11 circuit) as described in part e of Note 17.

c. Ignition On—Gage Registers Low Temperature Under All Conditions

1. Turn ignition switch ON. If gage registers low temperature after engine is heated up, proceed to step 2 and continue until defective component is isolated.

2. Check thermogage unit as described in part d of this note.

3. Check for a defective dash unit as described in part e of this note.

4. Check for an open 18 dark green wire from printed circuit to thermogage unit as described in part c of Note 17.

5. Check for an open printed circuit (#11 circuit) as described in part e of Note 17.

d. Engine Thermogage Unit Check

1. Disconnect dark green wire at thermogage unit.

2. Connect a test lamp consisting of a three-candlepower bulb and a pair of test leads in circuit by clipping one lead to battery terminal of starter solenoid and other lead to terminal of thermogage unit. Test bulb should not light. If it does light when connecting in this manner, thermogage unit is shorted and should be replaced.

3. Remove test lead from gage terminal and touch it to body of unit. Bulb will light if unit is grounded properly. If it does not light, check for presence of sealing compound around threads of unit. Remove compound and repeat test.

NOTE: Never use any sealing compound on

thermogage unit to stop water leaks. If tightening unit does not stop leakage, it should be replaced.

4. Remove test lamp and install dash gage wire on thermogage unit if it tests satisfactorily.

e. Temperature Gage Dash Unit Check

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove protective cover from temperature gage, taking care not to physically damage printed circuit.

3. Remove multiple connector at instrument panel cluster case.

4. Using an 18 gage jumper wire, connect one end to battery terminal of starter motor solenoid and other to stud that is closest to left fender. Temperature gage should read "low" temperature.

5. Using a second jumper wire, ground the remaining right lead stud on the temperature gage. Gage should now read "high" temperature. If gage does not read as described in steps 4 and 5, it should be replaced.

6. Disconnect jumper wires.

7. Connect multiple connector at instrument panel cluster case.

8. Install protective cover on temperature gage.

9. Install upper instrument panel cover as described in Note 37b.

17. Checking Circuits Using Printed Circuit

If any of the following circuits do not operate properly, check the corresponding notes to isolate the problem: fuel gage circuit, Note 10; high beam indicator circuit, Note 12; Cruise Control circuit, Section 15, Note 15; trunk lid circuit, Note 13; low brake circuit, Note 14; oil pressure tell-tale circuit, Note 15; charging circuit, Section 12, Note 37; temperature circuit, Note 16.

If performing checks on the illumination circuit or clock circuit, proceed directly to this note.

a. Checking For Burned Out Tell Tale Bulb

1. On all circuits using tell-tale bulbs, remove upper instrument panel cover as described in Note 37a.

2. Remove wedge base socket bulb for affected circuit, Fig. 12-17 and replace if necessary.

3. If bulb is all right, install and proceed to part b of this note.

b. Checking Instrument Panel Feed Circuits For Open

1. Remove upper instrument panel cover as described in Note 37a, if not done previously. Leave battery cable attached.

2. Disconnect 12-way connector at back of instrument panel cluster case.

3. Use the following table to identify the circuit wiring color code and perform preliminary steps needed to check the continuity, Fig. 12-17.

Hot Circuit	Wire Color Code	Preliminary Steps
Hi-Beam Indicator	18 Light Green	Headlamp switch all the way out. Dimmer switch on Hi-Beam.
Illumination	18 Gray	Headlamp switch halfway or fully out.
Cruise Control Automatic Indicator	18 White with Black Stripe	Ignition switch in on position and Cruise Control selector switch lever in "AUTO" position.
Clock and trunk lid	18 Orange	
Ignition, which feeds all other instrument panel circuits other than those above and the map light circuit	18 Pink	Ignition switch in on position.

4. To check any circuit, touch one lead of a test lamp that is not self-powered to terminal at wiring harness connector of affected circuit and ground other lead. Test lamp should light. If it does not light, trace the circuitry to the harness connector using chassis circuit diagram at back of this section. If test lamp lights, proceed to part c of this note.

c. Checking Sender Circuits or Switch Side of Circuit for Open

1. Remove upper instrument panel cover as described in Note 37a, if not done previously.

2. Disconnect 12-way connector at back of instrument panel cluster case, if not done previously.

3. Use the following table to identify the circuit wiring color code and perform the necessary preliminary steps needed to check the continuity of the circuit.

Sender or Switch Circuit	Wire Color Code	Preliminary Steps
Fuel Gage (Sender Side)	18 Tan	Disconnect and ground brown wire at connector inside license plate mounting door. On 693 styles ground tan feed wire at connector just inside trunk.
High Beam Indicator	18 Light Green	Disconnect and ground double light green lead at dimmer switch connector.
Trunk Lid (Switch Side)	18 Dark Green with White	Deck lid open.
Low Brake (Switch Side)	18 Tan with White	Disconnect 18 Tan with White wire at Cruise Control and low brake indicator switch. Ground 18 Tan with White wire with jumper wire.
Oil Pressure Tell-Tale	18 Dark Blue	
Temperature (Sender Side)	18 Dark Green	

4. To check the circuit, touch one lead of a test lamp that is self-powered to terminal at wiring harness connector of affected circuit and ground other lead. Test lamp should light. If it does not light, trace circuitry wiring and affected sender or switch by using chassis circuit diagram at back of this section. If it does light, proceed to part d of this note.

d. Checking Sender Circuits or Switch Side of Circuit for Short

1. Remove upper instrument panel cover as described in Note 37a, if not done previously.

2. Disconnect 12-way connector at back of instrument panel cluster case, if not done previously.

3. Use the following table to identify the wiring color code of the circuit and perform the necessary preliminary steps needed to check the circuit for shorts, Fig. 12-17.

Sender or Switch Circuit	Wire Color Code	Preliminary Steps
Fuel Gage (Sender Side)	18 Tan	Disconnect wire at connector inside license plate mounting door. On 693 styles, disconnect tan feed wire connector inside trunk.

Sender or Switch Circuit	Wire Color Code	Preliminary Steps
Trunk Lid (Switch Side)	18 Dark Green with White	Disconnect wire at deck lid.
Low Brake (Switch Side)	18 Tan with White	Disconnect 18 Tan with White wire at Cruise Control and low brake indicator switch.
Oil Pressure Tell-Tale (Sender Side)	18 Dark Blue	Disconnect 18 Dark Blue wire at oil pressure switch.
Temperature (Sender Side)	18 Dark Green	Disconnect 18 Dark Green connector at thermogage unit.

4. To check the circuit, touch one lead of a test lamp that is self-powered to terminal at wiring harness connector of affected circuit and ground other lead. Test lamp should not light. If it does light, trace the wiring from the affected sender or switch and repair short in wiring by using chassis circuit diagram at back of this section.

e. Checking Printed Circuit

If an open circuit cannot be found using the procedures previously described, check the affected circuit as outlined below.

1. Remove upper instrument panel cover as described in Note 37a, if not previously removed.

2. If bulbs are all right, remove instrument panel cluster assembly as described in Note 39a.

3. Examine the printed circuit affected for signs of damage using Fig. 12-17. If necessary, a self-powered test lamp may be used to check the continuity of these circuits. Check both the feed or hot circuit and the ground, switch or sender feeds for the affected circuit. If defective, the printed circuit must be replaced as described in Note 41.

4. If the clock still does not operate properly, it should be replaced on a trial basis.

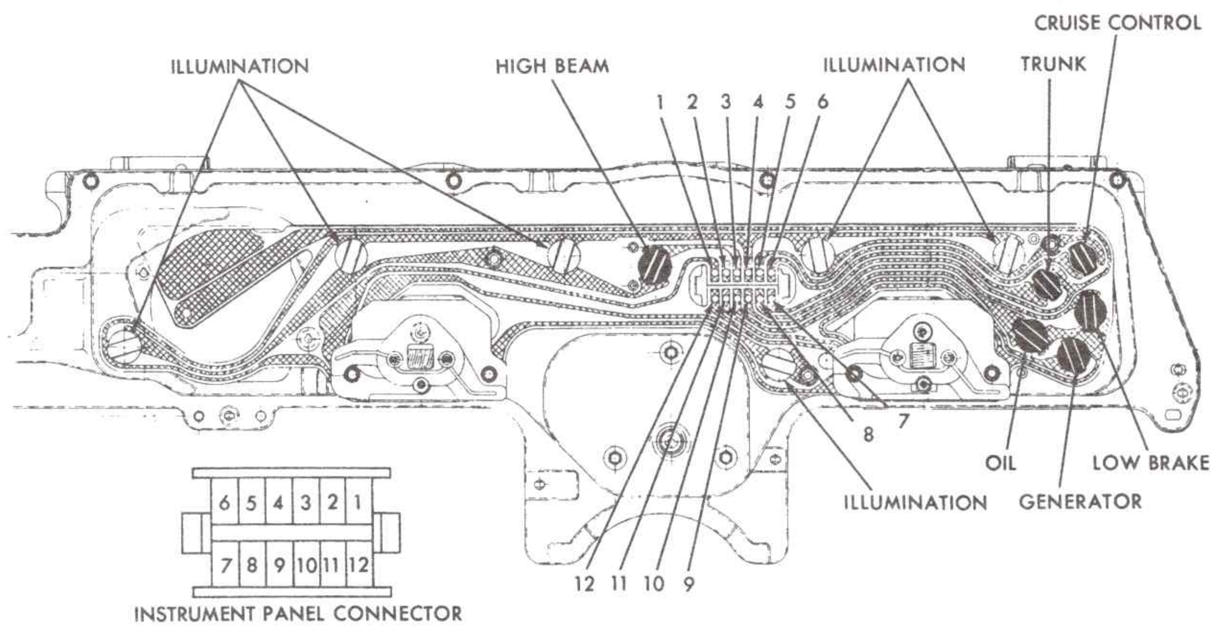


Fig. 12-17 Printed Circuit

PRINTED CIRCUIT LEGEND

No. and Circuit	Wiring Color Code	No. and Circuit	Wiring Color Code
1. Fuel Gage (Sender Side)	18 Tan	8. Low Brake (Switch Side)	18 Tan with White
2. Blank			
3. Hi-Beam Indicator . . .	18 Light Green	9. Oil Pressure Tell Tale (Sender Side)	18 Dark Blue
4. Illumination	18 Gray	10. Generator Tell Tale (Sender Side)	18 Brown
5. Cruise Control Automatic Indicator Tell Tale.	18 White with Black	11. Temperature Circuit (Sender Side)	18 Dark Green
6. Trunk Lid (Switch Side)	18 Dark Green with White		
7. Clock and Trunk Lid (Feed Side)	18 Orange	12. Ignition - Feeds Fuel Gage, Oil Pressure Tell-Tale, Generator Tell-Tale, Temperature Circuit and Low Brake Circuits	18 Pink

18. Speedometer Head Assembly

a. Disassembly

1. Remove speedometer head assembly as described in Note 40a.

2. Remove two dial retaining screws, being careful not to mar dial.

3. After recording mileage, remove two screws securing the plastic high beam tell-tale housing lift out total odometer. Do not attempt to disassemble the odometer. It is serviced as a complete unit.

4. Lift out trip odometer with end spring on left side of shaft and interconnecting gear on right side.

5. Remove idler gear, trip odometer reset gear, bushing and odometer engaging spring by lifting shaft slightly on left and pulling out to remove.

6. Remove third gear retainer plate screw and plate, then remove trip odometer reset spring.

7. Odometer reset shaft can now be removed.

8. With the third gear retainer plate screw and plate off lift out yellow third gear.

NOTE: Further disassembly requires removal of field plate and speed cup assembly and subsequent recalibration of speedometer. If speedometer tester is not available for recalibration, repairs needing disassembly beyond this point should be referred to a United Motors Service Station.

9. Carefully remove white painted aluminum pointer assembly (press fit). Turn against zero stop and lightly lift pointer assembly at hub.

10. Remove two screws securing jewel plate. Remove jewel plate.

11. Remove two screws securing field plate to frame and remove field plate and speed cup by lifting out by the speed cup spindle.

12. Inspect second gear for signs of damage. Do not remove unless necessary, as usually this gear will break while being removed. If necessary, remove second gear as follows:

a. Place bushing side of frame on wood block, but be certain bushing area is not obstructed by wood block.

b. Insert 1/8" punch or rod inside frame and against rear of bushing.

c. Carefully drive out bushing.

NOTE: Further disassembly, such as removal of the magnet shaft from frame, and speed cup assembly is not recommended.

b. Assembly

1. If removed, position second gear in frame assembly with gear end contacting worm gear on

magnet shaft. Install by tapping bushing squarely into frame with rawhide mallet or similar tool until end play .005" to .025".

2. Position third (yellow) gear with bevel gear end engaging worm gear end on second gear.

3. Install trip odometer reset shaft, position reset shaft return spring so that spring is actuated when shaft is depressed.

4. Holding spring in position, install retainer plate and screw, being sure second gear is in plate hole.

5. Position the shaft containing the idler gear, trip odometer reset gear and odometer engaging spring in frame engaging the right end into the frame hole first.

6. Make sure trip odometer is clean of fingerprints by wiping with a lintless cloth or soft chamois.

7. Install trip odometer with end spring and interconnecting gear, making sure slotted ears of pinion carriers fit in positioning slot in frame.

8. Wipe total odometer clean of fingerprints with a lintless cloth or soft chamois.

9. Install total odometer, making sure slotted ears of pinion carriers fit in positioning slot in frame.

10. Secure odometers by installing the high beam tell-tale housing and two screws.

11. If removed, install speed cup and field plate by holding speed cup spindle and guiding assembly onto dowels. Retain with two screws and tighten uniformly.

NOTE: Make sure speed cup stop tap is on correct side of field plate so as to permit needle rotation. Hairspring coil on speed cup must be evenly spaced when in wound position. It may be necessary to use tweezers to adjust coils. Move regulator arm to horizontal position, if necessary, so that maximum adjustment may be made in either direction during calibration.

12. If removed, install jewel plate with cup end up. Place one drop of rislone-type oil in jewel. Carefully wipe off excess oil.

13. Rotate all odometer wheels to the top of their travel.

14. Position speedometer dial on dowels, and secure with two screws.

15. Mount pointer on tapered spindle so that it points at approximately 30 MPH and twist back to, and in line with, "0" graduation while pressing down lightly. Tap pointer very lightly with handle end of screwdriver to secure in position.

16. Check for secure pointer to spindle contact by inserting a short piece of speedometer cable with proper tip in drive end of speedometer. An initial fast spin of test cable should swing pointer to approximately 30 MPH and then briskly return to "0". Perform this test several times. If pointer becomes loose on spindle, repeat step 15.

17. If during the performance of step 16, pointer returns to "0" intermittently or not at all, this indicates a speed cup and magnet assembly defect.

18. If field plate and speed cup assembly were removed, calibrate speedometer assembly, following the instructions furnished by the manufacturer for the speedometer tester being used.

19. Install speedometer head assembly as described in Note 40b.

19. Directional Signal Service

The switch that operates the front fender cornering light is integral with the directional signal switch.

It is part of the switch block included in the switch assembly, and is serviced with the switch. Automatic cancelling of the turn signal lights and cornering lights when lit is achieved by means of a cam connected to the steering wheel hub and a ratchet that is integral with the switch assembly. When the steering wheel is turned in the direction for which the control is set, the cam passes the ratchet without engaging, but when the wheel is turned in the opposite direction, the cam engages the ratchet and cancels the signal and cornering light.

The signal flasher, which is identical for both columns, is a sealed non-adjustable unit located on the fuse panel. If inoperative, it must be replaced. The flasher makes an audible signal when the circuit is energized. This serves as an additional warning that the signal is operating.

When the signal system is operating properly, the lights flash about 70 to 90 times per minute at 12.8 volts. If either a front or rear turn signal bulb burns out, the reduced current in the circuit will cause the remaining signals on that side of the car to burn steadily.

20. Directional Signal Switch and Hazard Warning Switch

a. Removal (Standard Wheel)

1. Remove directional signal switch or hazard warning switch as described in Section 9, Note 19a, steps 3 through 14, omitting step 8.

b. Installation

1. Install directional signal switch or hazard warning switch as described in Section 9, Note 19c, steps 9 through 25.

c. Removal (Tilt and Telescope Wheel)

1. Remove directional signal switch or hazard warning switch as described in Section 9, Note 24a, steps 3 through 16.

d. Installation (Tilt and Telescope Wheel)

1. Install directional signal switch or hazard warning switch as described in Note 24c, steps 23, and 27 through 39.

21. Horn Operation and Testing

Conditions that may affect horn performance and procedures for checking these conditions are listed below:

a. Horn Inoperative or Blows Intermittently

1. Depress cushion at each of three spokes in turn to energize horn. Horn should blow at any spoke. If horn blows at one spoke but fails to blow at either or both remaining spokes, the fault is in the circuitry in the wheel. Refer to Note 22 for servicing wheel. If horn fails to blow at all spokes, proceed as outlined below.

2. While energized, tap horn lightly. If horn blows, proceed to step 3. If horn fails to blow, refer to step 6 of this procedure.

3. Release cushion so that horn will stop blowing.

4. Energize horn again. If horn blows normally, a particle of foreign material between the contact points caused the trouble and no adjustment is necessary.

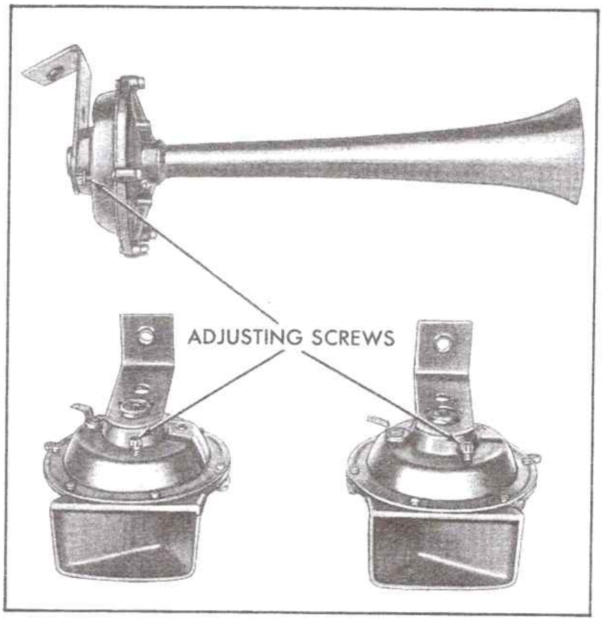


Fig. 12-18 Horn Adjusting Screw

5. If horn still fails to blow until tapped, turn adjustment screw, Fig. 12-18, one full turn counterclockwise with pliers.

> CAUTION: This adjustment is sensitive. Do not turn screw more than one full turn or in wrong direction (clockwise). Misadjustment will require removing horn for adjustment on bench as described in Section d of this note.

6. Check horn for normal operation and if still inoperative, perform the following checks.

a. Connect a jumper lead to "H" and middle terminals of horn relay.

b. If horn blows, trouble is in relay, horn control or wiring.

c. To determine whether relay, horn control, or wiring is at fault, ground "S" terminal of relay.

d. If horn blows, horn control or wiring is at fault.

e. If horn does not blow and wiring between battery and relay is not defective, connect a voltmeter between horn terminal and horn mounting nut.

f. Connect a jumper lead to "H" and middle terminals of relay and note voltmeter reading.

g. If no voltmeter reading is obtained, wiring between relay and horn is open or horn is not grounded.

h. If voltmeter reading is less than 7.0 volts,

trouble is due to high resistance connections in wiring or a faulty horn.

i. If voltmeter reading is above 7.0 volts, trouble is due to a faulty horn. In this case, test horn for current draw.

7. If no trouble is located during these checks and horn is still inoperative, remove horn for a bench check.

b. Horn Tone Poor

1. Harsh tone - caused by loose bolts in sheet metal mounting area.

2. Low pitch roar - sounds like "moo-ing" and is caused by too high a current. Horn needs adjusting.

3. Weak tone - caused by too low a current. Horn needs adjusting.

4. Weak strained tone - foreign body in horn trumpet that should be shaken out or removed.

5. Harsh vibration - caused by horn touching sheet metal. Bracket should be bent to give horn clearance and freedom from interference.

c. Horn Blows Constantly

1. This can be caused by a sticking horn relay.

2. Horn relay may be energized by grounded or shorted wiring.

3. Contact at any of three screws securing horn contact wires with reverse side of cushion is another cause.

NOTE: Most horns with burned open winding are caused by one of the above malfunctions. Before replacing horns with open windings with new horns, make sure that none of the above conditions exist, or the horn winding will again burn open.

d. Bench Checks

1. Measure current draw of horn while horn is operating. Current draw for each horn should be between 4.5 and 5.5 amperes at 11.5 to 12.5 volts.

2. No current may indicate a broken connection or an open circuit due to a broken lead or to overheating. Most horn failures are caused by horns being operated continuously, which develops sufficient heat to melt the wires in the winding, causing an open circuit. Overheating is accompanied by a characteristic odor which indicates that horn should be replaced.

3. No current can also indicate that the contact points are open and a current adjustment is required. Turn adjusting screw counterclockwise.

4. High current, over 20 amperes, indicates an overheated winding or shorted horn which should be replaced.

5. A reading of approximately 18 amperes for a 12-volt horn indicates a condition in which the contact points are not opening. A current adjustment is required by turning the adjusting screw clockwise.

e. Current Adjustment

Turn adjusting screw, Fig. 12-18, counterclockwise to increase current or clockwise to decrease current until specified current is reached. Care must be taken not to turn the adjusting screw too far. Turn only 1/4 of a turn at one time. If adjustment loosens the screw excessively, it may be staked with a punch.

f. Cold Weather Adjustment

If horn fails to blow in cold weather, it is possible that current limit is set too low although still within 4.5 - 5.5 ampere limit (each horn) at 12.0 volts. Turn adjusting screw 1/4 turn counterclockwise (90°) to increase draw, Fig. 12-18.

CAUTION: This adjustment should not be made unless horn fails to blow. A current increase on a properly operating horn can result in complete failure of unit.

22. Horn Contact Assembly

a. Removal

1. Remove steering wheel as described in Section 9, Note 17a.

2. Remove three screws securing three contact wires to wheel.

NOTE: These screws provide the horn contact at the wheel.

b. Installation

1. Position horn contact wires at wheel and secure with three screws.

2. Install steering wheel as described in Section 9, Note 17b.

23. Clock Regulation and Resetting

The accuracy of automobile clocks operating on direct current should not be compared too closely with that of electric clocks operating on alternating current. The frequency of alternating current is controlled and corrected constantly at the power source, thereby eliminating accumulation of errors. A car clock is spring-operated and electrically wound. Time errors are accumulated day by day.

An automobile clock is considered a good time piece when at normal temperatures the consistent gain or loss does not exceed seven minutes per week. Accumulation of this error can amount to as much as thirty minutes during a month.

The owner must anticipate resetting the hands occasionally. This should be explained to owners at new car delivery. It is possible to regulate the clock so that the variation will be less than seven minutes weekly if care is taken as described below.

The reset knob projects from the center of the lower edge of the clock. To reset, pull reset knob all the way out and turn until hands are at desired time. Keep the reset knob fully pulled out during adjustment, otherwise, automatic regulator may not engage. Resetting clock in either direction will automatically regulate clock to run approximately 20 seconds per day faster or slower, depending on which way clock is set. If more than a 20 second adjustment is required, reset clock after 12 hours have elapsed. This setting will give an additional 20 seconds slower or faster.

The special oils used to lubricate automotive clocks tend to deteriorate with age. If timekeeping characteristics of the clock become erratic, it should be removed and sent to the clock manufacturer's authorized clock repair station for cleaning and re-oiling. Cleaning and re-oiling is recommended at least once every two years.

24. Back-Up Light and Neutral Safety Switch Removal and Installation

The neutral safety switch, back-up light switch, and parking brake vacuum release valve are combined into one unit mounted on the steering column under the instrument panel.

a. Removal

1. Place transmission shift lever in neutral.

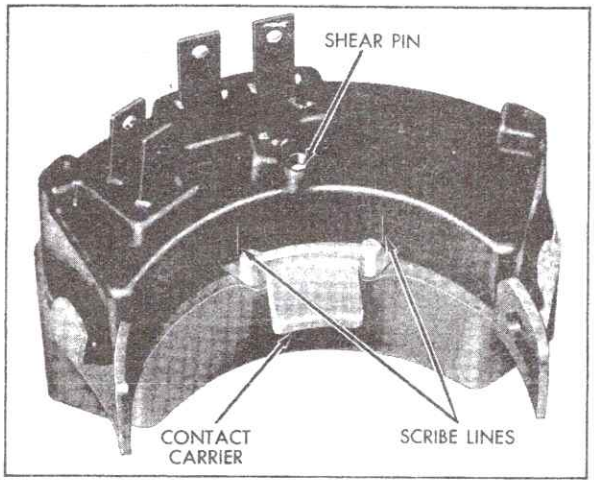


Fig. 12-19 Switch in Neutral

2. Remove two mounting nuts and carefully remove switch from steering column being careful not to disturb position of contact carrier.

3. Mark position of contact carrier, Fig. 12-19.

4. Mark top vacuum hose for identification and remove hoses.

5. Disconnect two wiring connectors from switch.

b. Installation

1. Place transmission shift lever in neutral position.

2. Connect two wiring connectors to switch.

3. Move contact carrier on switch assembly to neutral position as marked during removal, Fig. 12-19. If necessary to install a new switch, the switch will be secured in neutral by a shear pin. Do not break pin.

4. Install switch assembly on steering column, aligning contact carrier blade with slot in shift tube.

5. Secure switch to steering column with two mounting nuts, making sure that shift lever is centered in the Neutral position while this operation is performed.

6. Connect vacuum hoses to switch as marked during removal.

7. Switch should now be properly adjusted. If new switch was installed, a slightly greater effort to position the shift lever in any position besides neutral will be necessary, because it will be necessary to break the shear pin. Check operation as described in Step 1 of Note 25.

25. Back-Up Light and Neutral Safety Switch Adjustment

Check transmission linkage adjustment as described in Section 7, Note 4, on all but 693 styles or Note 22 on 693 styles before adjusting switch.

1. Switch should operate as described below:

a. Engine should start in PARK and NEUTRAL positions only.

b. Back-up lights should operate when transmission shift lever is placed in REVERSE position.

c. Parking brake should release in any drive range with engine running.

A vacuum leak that can be corrected by moving the shift lever is an indication that the switch is improperly adjusted and not defective. The switch should be adjusted in this situation. Adjust as described below:

2. Loosen mounting nuts on switch.

3. Place transmission shift lever in NEUTRAL position.

4. Adjust switch until engine starts in NEUTRAL position. Tighten mounting nuts and test operation as described in Step 1.

26. Electrical Accessory Installation

When installing additional electrical equipment, such as Rear Window Defogger or Twilight Sentinel, connect this equipment to the proper terminals in the wiring harness or the accessory terminal on the fuse panel in accordance with the instructions provided with the accessory. Care should be exercised in installing accessories other than those that are Cadillac designed to avoid over-loading the electrical system.

GENERAL DESCRIPTION

WINDSHIELD WIPER AND WASHER SYSTEM

All windshield wiper and washer information may be found in this portion of Section 12 with the following exceptions: The removal and installation of the windshield wiper and washer switch is covered in Note 55 in the instrument panel portion of this section and the removal and installation of the shroud top ventilator frame and grille and windshield wiper transmission are described in Notes 82 and 83 respectively.

A three-speed windshield wiper and washer system is used on all 1967 Cadillac cars. The windshield wiper and washer assembly is mounted at the left side of the cowl. The wiper unit drives a center drive arm connected to two wiper transmission link arms. The wiper unit link arms drive two individual wiper transmissions.

The wiper and washer assembly consists of a wiper unit, which contains a 12-volt motor, a gear box section, a relay control, and a washer unit.

The wiper and washer assembly is controlled by a three-way switch located on the left side of the lower instrument panel to the left of the steering column, Fig. 12-20. The wipers can be operated at three different speeds as desired. The washers are activated by rotating down the washer button, integral with the switch. When the washer button is rotated the switch lever is moved mechanically to the low speed position. The lever will then stay in the low speed position until the operator moves it to the "OFF" position.

Wiper Electrical Operation

LOW SPEED - Moving the control switch lever to the "Lo" speed position, Fig. 12-21, connects the relay control and shunt field circuit directly to ground. This provides the following circuit:

Current flows through the 16 pink wire to the 25 amp windshield wiper fuse in the fuse panel and on through the 18 yellow wire to terminal number

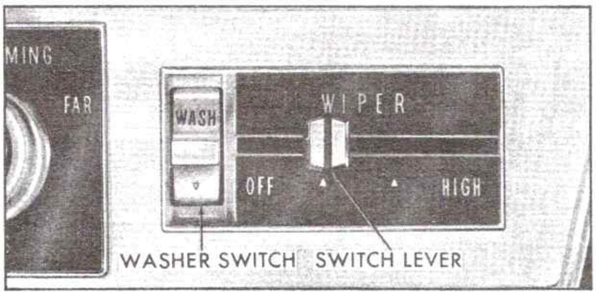


Fig. 12-20 Wiper and Washer Control Switch

2 of the wiper motor. It then flows through the tan wire to one contact point on the relay switch, and on through the red wire, the relay coil and through the red wire back to terminal No. 1, through the light blue wire and the dash switch to ground. After passing through the relay points, current flows through the black with pink stripe wire through the series field and divides; part flowing through the armature and circuit breaker and through the black ground wire, the other part flowing through the shunt field, the solid black wire to terminal number three, and on through the black with orange stripe wire to ground at the control switch. Current by-passes the 20 ohm resistor ground circuit at terminal No. 3 at this time because of the lower resistance of the control switch ground circuit.

MEDIUM SPEED - Moving the control switch to the "Medium" speed position (center), Fig. 12-21, connects a 13 ohm resistor, located in the control switch, in parallel with the twenty ohm resistor connected from the shunt field circuit. These two resistors, connected in parallel, provide slightly less than eight ohms resistance in the shunt field allowing less current to flow in the shunt field. This permits correspondingly more current in the series field circuit, resulting in medium speed.

HIGH SPEED - Moving the control switch lever to the "High" speed position (right), Fig. 12-21, eliminates the path to ground in the control switch, leaving only the one 20 ohm resistor in the shunt circuit. This one resistor allows even less current to flow through the shunt field than was possible at either the medium or low speeds, which results in high speed operation.

Wiper Mechanical Operation

In the "Off" position, the wiper gear drive pawl is located in a slot in the relay and switch assembly, Fig. 12-22. In this position it is pushing against a spring loaded latch arm. The latch arm, in turn, is pushing against a flexible switch contact that holds the switch contacts open.Fig. 12-22 shows the wiper gear mechanism in the "Park" of "Off" position.

When the switch lever is moved to any drive position, the circuit through the relay and switch assembly coil is completed to ground at the dash switch. The motor shunt field ground connection at the dash switch is maintained. With the relay magnet coil energized, the latch arm is attracted to the magnet coil. This action trips the latch arm away from the flexible relay switch contact bar, and this allows the switch contact points to close. When the contact points close, the feed to

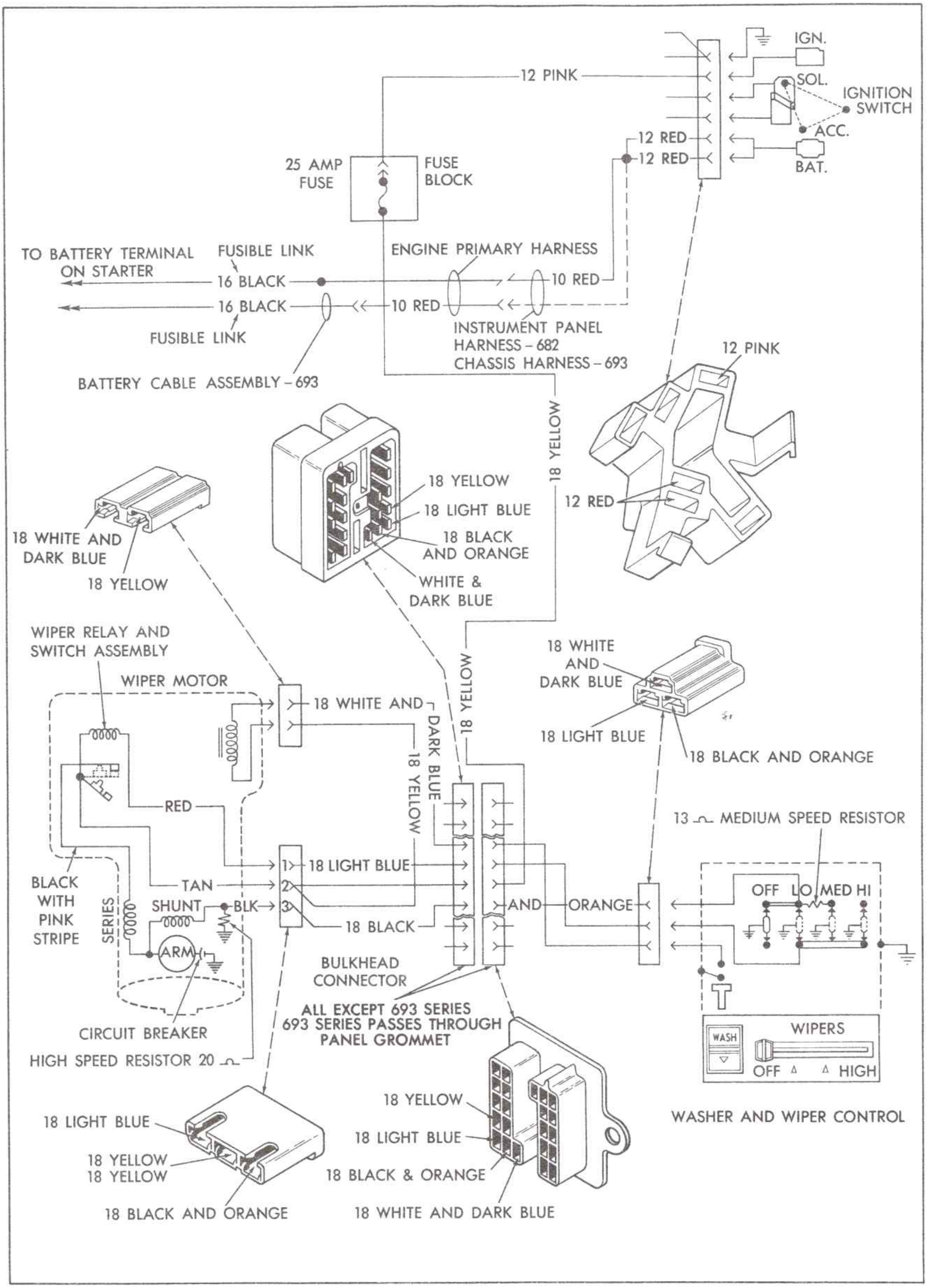


Fig. 12-21 Wiper and Washer Electrical Circuits

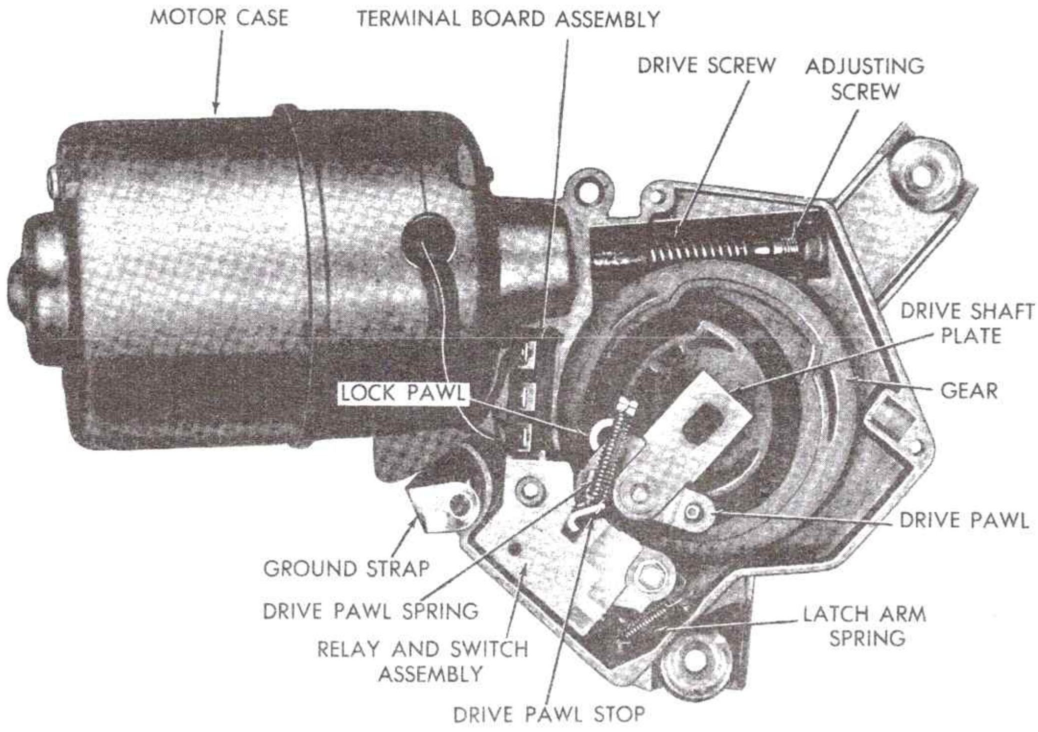


Fig. 12-22 Wiper Drive Mechanism

the wiper motor windings is completed and the wiper motor starts.

When the wiper motor first starts, only the gear rotates. The other gear assembly parts (drive pawl, lock pawl, drive plate and shaft, and crank arm) are unlocked with the gear because the drive pawl extends into the relay switch slot.

Since the gear rotates independently during this stage of the "start up", and since the crank arm or output shaft extends through the gear shaft "off center", a cam action results between the output shaft and gear shaft. This cam action causes the drive pawl to move out of the relay switch slot. After the gear has rotated approximately 180 degrees, the spring loaded drive and lock pawl guide pins snap into their respective pockets in the gear, locking the drive or output shafts and related parts to the gear. The complete gear mechanism is now in its normal run position, and the gear, drive pawl, lock pawl, drive plate and shaft assembly and crank arm rotate as a unit.

Moving the dash switch lever to the "Off" position opens the relay coil circuit to ground at the dash switch. With the relay coil circuit open, the spring loaded relay latch arm moves out into the path of the gear assembly drive pawl.

The relay switch contact points are still closed at this stage of operation, so the circuit to the wiper motor is still completed. Thus the wiper motor and gear mechanism continues to run. The continuing rotation of the gear assembly causes the drive pawl to engage the latch arm. This action unlocks the drive pawl, lock pawl, drive plate and shaft assembly, and crank arm from the gear, which prevents them from rotating with the gear. However, since the relay switch contact points are still closed, the motor continues to run and the gear continues to rotate. Since the drive shaft extends through the gear shaft "Off center", a cam action results. The resulting cam action causes the drive pawl to move into the relay switch slot. As the drive pawl moves into the switch slot, it pushes against the latch arm which in turn opens the switch contact points. This action opens the circuit to the wiper motor and the wiper motor stops.

Washer Circuit

Rotating the washer button on the control switch down mechanically moves the switch lever to the "Lo" speed position. The washer relay coil is energized by the current flowing from the No. 2 terminal on the wiper unit connector through the yellow wire into the relay coil and from there

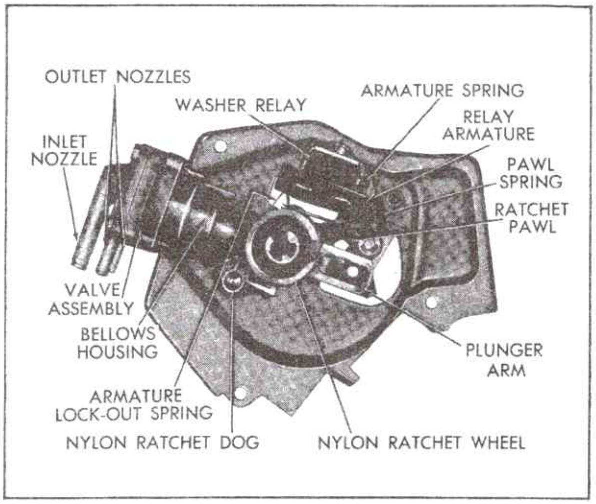


Fig. 12-23 Washer Unit

through the white with dark blue stripe wire to ground in the control switch.

Washer Mechanical Operation

The washer unit is driven by a pin attached to the drive plate and shaft assembly in the wiper unit. This pin fits into the washer rotor cam and drives the pump, at idle, whenever the wiper unit is in operation.

When the washer button is rotated down, the washer circuit is completed to ground and the washer relay is energized, pulling the relay armature and ratchet pawl away from the nylon ratchet wheel, Fig. 12-23. At this point, the wire stop slips into position and holds the relay armature away from the ratchet wheel, allowing the ratchet pawl, which was previously moving back and forth through the armature opening to drop out of the opening and start to rotate the ratchet wheel.

The plunger arm slips off the eccentric at the bottom of the ratchet wheel and moves in the direction of the bellows. This action causes the bellows to collapse and forces water from the bellows out through the outlet valve to the nozzles. As the plunger arm starts on its return travel, water is drawn through the inlet valve and refills the bellows for the next exhaust stroke.

The action is repeated through the 21 teeth on the ratchet wheel. As the ratchet wheel completes its rotation, the tang on the armature slips into the recess of the ratchet wheel, which then allows the ratchet pawl to disengage from the wheel and move freely through the armature, and the washer is again in the idle position.

27. Windshield Wiper and Washer Unit

a. Removal

1. Disconnect negative battery cable at battery.

2. Disconnect three washer hoses from washer unit control valve. Mark small outlet hoses and corresponding control valve nozzles for identification.

3. Disconnect two-way wire connector at washer unit and three-way wire connector at wiper unit.

4. Remove cover from opening in left side of cowl to gain access to wiper unit crank arm.

NOTE: Cover is located above wiper and washer assembly.

5. Loosen two locknuts securing wiper unit crank arm to ball socket on end of transmission drive linkage, then disengage crank arm from ball socket, Fig. 12-24.

CAUTION: Do not remove locknuts from ball socket studs.

6. Remove three screws that hold wiper and washer assembly to cowl and remove wiper and washer assembly from cowl.

b. Installation

1. Install wiper and washer assembly on cowl and secure with three attaching screws. Be sure wiper unit crank arm is in PARK position as shown in Fig. 12-25.

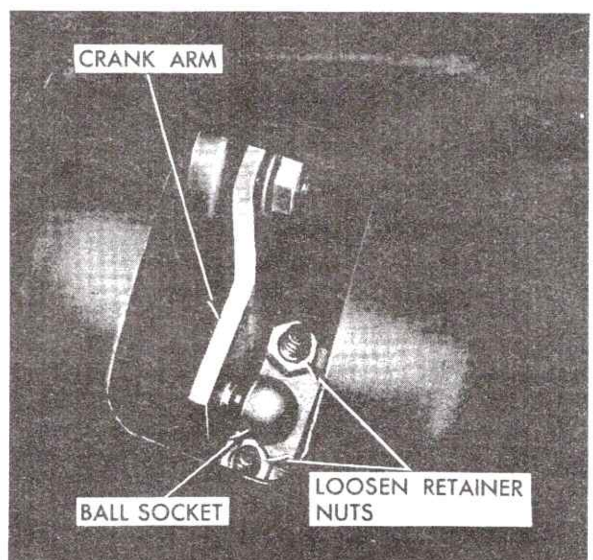


Fig. 12-24 Removing Crank Arm from Ball Socket

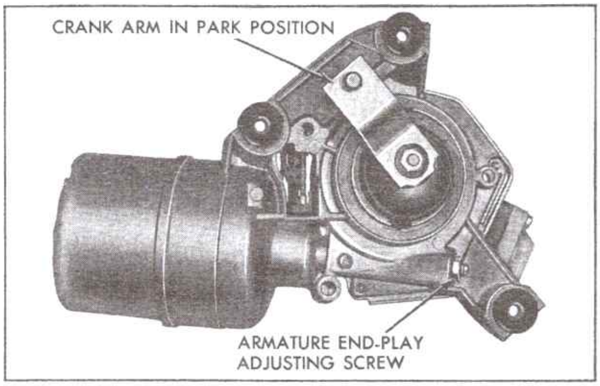


Fig. 12-25 Crank Arm in Park Position

2. Working through opening in cowl, install drive linkage ball socket on wiper unit crank arm and tighten two attaching locknuts that hold crank arm to ball socket, Fig. 12-24.

3. Place sealer on reverse side of cover and install cover into opening in left side of cowl.

4. Connect three-way wire connector to wiper unit.

5. Connect two-way wire connector to washer unit.

6. Connect three washer hoses to washer unit control valve as marked during removal.

7. Connect negative battery cable to battery.

8. Check operation of wiper and washer assembly.

28. Windshield Wiper Unit Disassembly and Assembly

NOTE: The following disassembly and assembly procedures for the wiper unit are broken down into two major areas: The motor section and the gear box section. Each section may be serviced independently of the other.

a. Motor Disassembly

1. Scribe a reference line along the side of the casting and motor case to insure proper reassembly, Fig. 12-26.

2. Remove the two motor through bolts.

3. Strike motor case lightly with a mallet to loosen it from casting.

4. Feed exposed excess length of motor leads through the casting grommet and carefully back the motor case and field assembly and armature away from the casting, Fig. 12-26.

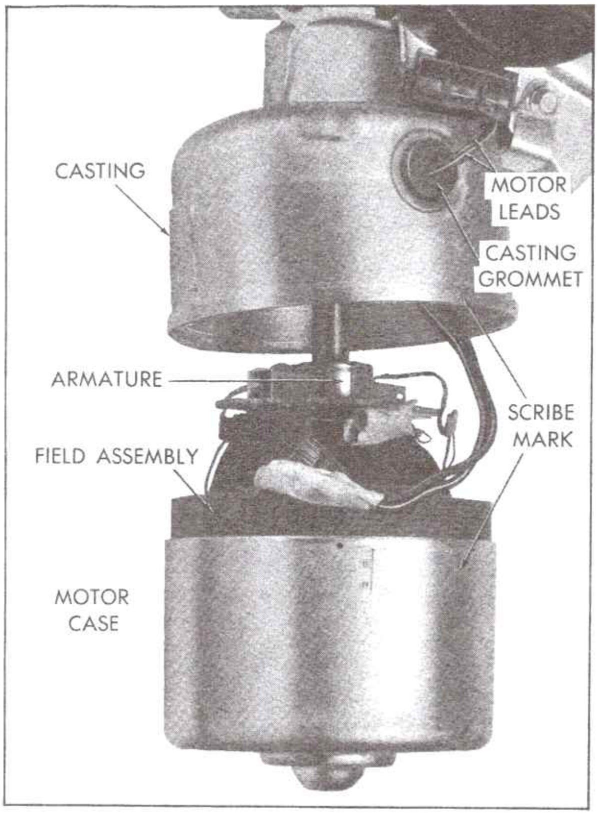


Fig. 12-26 Separating Motor Case from Casting

5. Unsolder the black lead from circuit breaker, Fig. 12-27.

6. Straighten out either set of two brush plate retainer tabs that retain the brush plate to the field coil retainers, Fig. 12-27.

NOTE: The tabs straightened must be on the same side of the brushes.

7. Install Brush Spring Retainer, J-7890, over brush holder that has brush lead attached to circuit breaker, Fig. 12-27.

NOTE: Brush Spring Retainer, J-7890, may be bent slightly on one leg.

8. Holding the opposite brush from that retained in step 7, carefully lift the brush plate off the mounting legs far enough to clear the armature commutator, Fig. 12-28.

9. Allow the brush, held in step 8, to move out of its holder. Remove the brush spring and lift the brush plate off the armature shaft.

10. Lift armature out of case and field assembly.

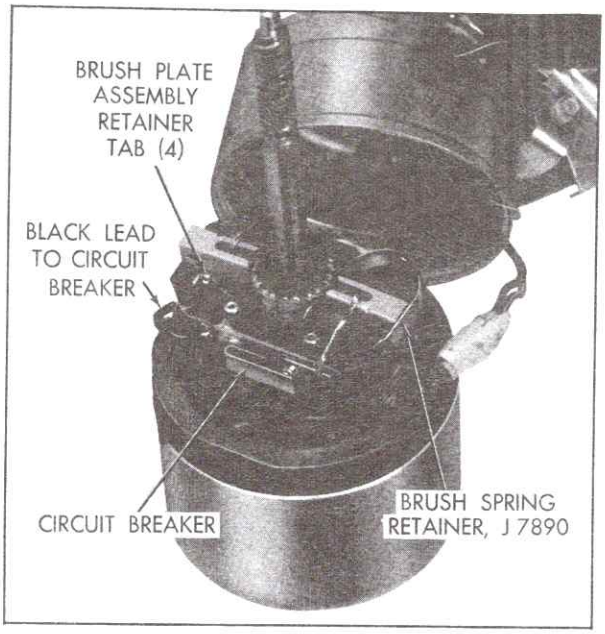


Fig. 12-27 Detaching Brush Plate

Fig. 12-28 Separating Brush Plate

11. If necessary to replace motor field assembly, cut the solid black and black with pink stripe leads in a location convenient for splicing - preferably near the wiper terminal board.

12. Remove felt washer, steel thrust disc and rubber thrust disc from case assembly bearing as required.

b. Motor Assembly

1. If necessary, splice the leads of the replacement case and field assembly to the corresponding wiper leads cut in step 11 of disassembly procedure. Solder and tape these joints. Refer to Fig. 12-27.

2. Install the rubber thrust disc, steel thrust disc and felt washer in the case assembly bearing in the order indicated.

3. Be sure steel ball is located in armature end of armature shaft.

NOTE: Replacement armatures are not supplied with thrust ball. To remove thrust ball from original armature, use a magnet.

4. Lubricate ends of armature shaft and thrust ball with high melting point - medium grade lubricant.

5. Assemble armature in the case and field assembly, Fig. 12-29.

6. Position the partially assembled brush plate, Fig. 12-29, over the armature shaft far enough to allow re-assembly of the remaining brush in its brush holder; then position the brush plate assembly on the mounting tabs in the position shown in Fig. 12-27.

NOTE: Circuit breaker ground lead will not reach circuit breaker terminal if brush plate is positioned wrong.

7. Center the brush plate mounting holes over the mounting tabs and bend the two tabs straightened during disassembly toward the brush holders as required to secure the brush plate in position.

8. Remove brush retainer clips and resolder circuit breaker ground lead to circuit breaker, Fig. 12-27.

9. If a new case and field assembly is used, scribe a line on the new case and field assembly

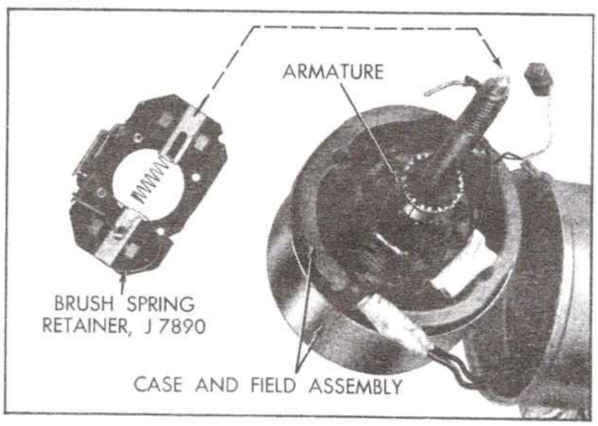


Fig. 12-29 Installing Armature and Brush Plate

in the same approximate position as the one scribed on the original case. This will insure proper alignment of the new case and field with the wiper die case housing.

10. Position armature worm shaft inside the housing and, using the scribed reference marks, line up the case and field assembly with the housing as nearly as possible.

11. Maintaining the armature in its assembled position in the case, start the armature worm shaft through the field and housing bearing until it starts to mesh with the worm gear. At the same time, carefully feed the excess black and black with pink stripe leads through the housing grommet. Be careful not to pinch any motor leads between case and edge of field.

CAUTION: It may be necessary at this point to rotate armature slightly before the worm will engage with worm gear.

12. Rotate the case as required to align the bolt holes in the case with those in the housing.

13. Secure the case to the housing with the two through bolts.

14. Loosen adjusting screw locknut and adjust screw as required until end of screw just touches end of armature. Then back-off adjusting screw 1/4 turn and tighten locknut.

c. Gear Box Disassembly

1. Remove three screws that hold washer unit to wiper unit and remove washer unit.

2. Remove nut that holds crank arm to drive plate and shaft assembly and remove crank arm.

3. Remove rubber boot seal.

4. Remove snap ring that holds drive gear to drive plate and shaft assembly, using Snap Ring Pliers, J-4880.

5. Remove end-play washers, shield, and spacer washer.

NOTE: The number of end-play washers may vary in different wiper assemblies due to end-play requirements.

6. Slide gear and drive plate and shaft assembly out of housing and remove spacer washer from gear eccentric shaft.

7. Slide drive plate and shaft assembly out of gear assembly and remove drive pawl, lock pawl, and coil spring from drive plate and shaft, Fig. 12-30.

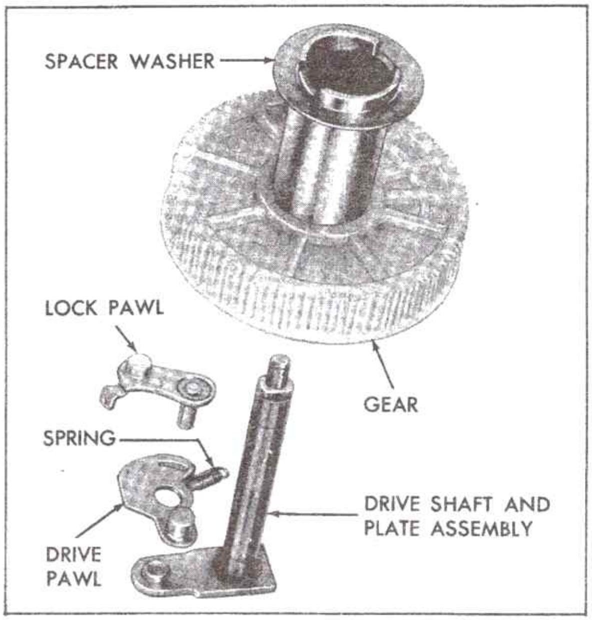


Fig. 12-30 Drive Shaft Assembly - Disassembled

8. Remove screw securing switch and relay assembly to housing and remove switch and relay assembly.

NOTE: If switch and relay assembly is defective, unsolder three leads attached to assembly. Solder leads to new switch and relay assembly.

9. Remove terminal board assembly from housing.

NOTE: If terminal board or 20 ohm resistor is defective, unsolder three leads attached to terminal board assembly. Solder leads to new terminal board assembly.

d. Gear Box Assembly

1. Slide terminal board assembly into wiper housing, being careful to position terminal board resistor lead as shown in Fig. 12-31.

NOTE: With the relay and switch assembly replaced in housing and washer pump reinstalled, relay and switch plastic housing applies pressure against resistor lead to form a positive ground connection to wiper housing.

2. Install relay and switch assembly into housing and secure with attaching screw.

CAUTION: Be very careful to route leads in such a manner as to avoid having them pinched between relay and wiper housing.

3. Assemble drive pawl and lock pawl on drive plate and shaft, Fig. 12-30.

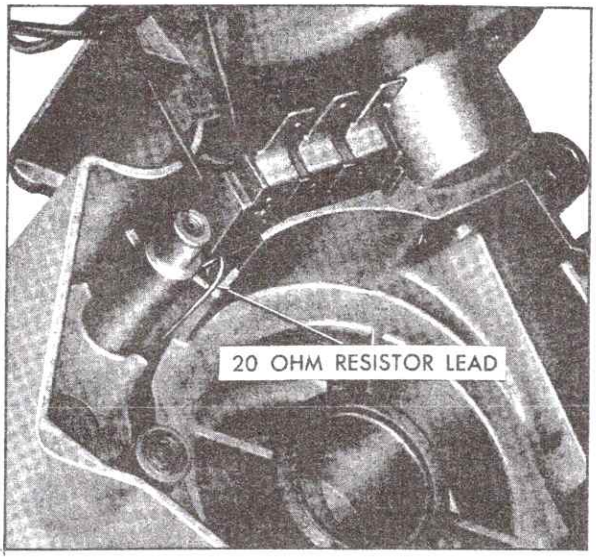


Fig. 12-31 Installing Terminal Board

4. Slide gear assembly over drive shaft, Fig. 12-30. Move drive and lock pawls as required to allow their respective pins to fit in the gear guide channel.

5. Holding gear, manually rotate drive shaft plate until drive and lock pawl guide pins snap into their respective pockets in gear.

6. Reinstall coil spring between lock and drive pawls.

NOTE: Be very careful to maintain lock and drive pawl guide pins in their respective pockets during step 7.

7. Assemble inner spacer washer over gear eccentric shaft and install gear mechanism in housing.

8. Install spacer washer, shield, and end-play washers on drive plate and shaft assembly, and secure with snap ring, using Snap Ring Pliers, J-4880.

NOTE: To determine if end-play is correct, place two .005 inch feeler gages, one on each side of the shaft, between snap ring and washers. Add or remove end-play washers as required to obtain a snug .005 inch clearance.

9. Pack rubber boot seal with a high melting point medium grade of lubricant and install seal over shield so that tang on shield is properly fitted to seal.

10. Operate wiper unit as described below in steps a through c, to allow wiper unit to return to normal park position before installing crank arm.

a. Connect jumper wire from No. 3 terminal to ground.

b. Connect 12 volt supply to No. 2 terminal and ground housing. Wiper unit should return to normal park position.

c. Disconnect 12 volt supply and jumper wire.

11. Install crank arm on drive plate and shaft assembly as shown in Fig. 12-25 and secure with attaching locknut. Tighten locknut securely.

12. Install three screws that hold washer unit to wiper unit, attaching ground strap under one of the attaching screws.

29. Windshield Washer Unit

a. Removal

1. Disconnect negative battery cable at battery.

2. Disconnect two-way wire connector at washer unit.

3. Disconnect three washer hoses from washer unit control valve. Mark small outlet hoses and corresponding control valve nozzles for identification.

4. Remove three screws that hold washer unit to wiper unit and remove washer unit from wiper unit.

b. Installation

1. Install three screws that hold washer unit to wiper unit.

NOTE: Be sure that ground strap is connected to one of the attaching screws.

2. Connect three washer hoses to washer unit control valve as marked during removal.

3. Connect two-way wire connector to washer unit.

4. Connect negative battery cable to battery.

5. Turn wiper ON and allow blades to make at least one normal wiper stroke, then turn wiper OFF.

NOTE: This step will align cam slot with drive pin. If cam slot does not engage first time, repeat step.

30. Windshield Washer Unit Disassembly and Assembly

a. Disassembly (Fig. 12-23)

1. Remove "C" washer securing cover to washer unit and remove cover.

2. Remove screw securing nylon ratchet dog to housing and remove ratchet dog and armature lock-out spring.

3. Disconnect ratchet pawl spring from ratchet pawl and relay housing and remove spring.

4. Remove "E" ring retainer securing ratchet pawl to large pivot arm shaft and remove ratchet pawl.

5. Disconnect end of relay armature spring from tang on relay housing and remove relay armature and spring.

6. Remove "E" ring retainer securing pump rotor cam to pump shaft and remove cam.

7. Remove four screws securing valve assembly to bellows housing and remove valve assembly.

8. To remove bellows from plunger arm assembly, push in on bellows, rotate bellows 90° to disengage from plunger arm, and remove bellows, spring retainer, and spring.

9. To remove relay and terminal board assembly from housing, carefully break off the four coil frame staking tabs, using a screwdriver, or similar tool, and hammer.

10. Remove relay and terminal board assembly from housing.

NOTE: The washer unit is not serviceable beyond this point. If remaining parts are defective, the washer unit must be replaced as an assembly.

b. Assembly (Fig. 12-23)

1. Install new relay and terminal board assembly on housing and stake assembly to housing in four locations.

2. Install pump rotor cam on pump shaft and secure with "E" ring retainer.

3. Install bellows spring and spring retainer over plunger arm in bellows housing.

4. Install end of bellows over locating tang on plunger arm, push in on bellows and rotate 90° to engage bellows to plunger arm.

5. Install relay armature on relay housing and secure with retainer spring.

6. Install ratchet pawl on large pivot arm shaft and secure with "E" ring retainer.

7. Install ratchet pawl spring so that long end of spring is connected to tang on relay housing and short end of spring is connected to tang on ratchet pawl.

8. Install ratchet dog on housing so that locating tangs line up with locating holes in housing.

9. Install armature lock-out spring in bore of ratchet dog, lining up spring with notch in ratchet dog.

10. Secure ratchet dog and armature lock-out spring to housing with attaching screw.

11. Install valve assembly on bellows housing and secure with four attaching screws.

CAUTION: Make certain flange on bellows is properly seated in groove in valve assembly.

12. Install cover on washer unit and secure with attaching "C" washer.

31. Windshield Wiper and Washer Unit Checking Procedures (On Car)

a. Chassis Wiring

1. Check for blown fuse at fuse panel.

2. Make sure chassis wiring is properly connected to wiper and washer assembly and dash switch.

3. Check to see that wiper unit ground strap is properly connected.

4. With ignition switch turned on, check for 12 volts at No. 2 terminal (yellow lead) of wiper unit terminal board, and at yellow lead terminal that connects to washer unit.

b. Dash Switch

1. Check dash switch mounting. Loose mounting can cause an intermittent operating condition when using wiper unit.

2. To determine if dash switch or wiper and washer assembly is defective, try operating wiper and washer assembly independently of dash switch and chassis wiring as follows:

a. Disconnect multiple connector at wiper unit.

b. Connect 12-volt supply to No. 2 terminal, Fig. 12-31, and connect a jumper wire from No. 1 terminal to ground. Wiper should operate in "Hi" speed.

c. To check "Lo" speed operation, connect a second jumper wire from No. 3 terminal, Fig. 12-32, to ground.

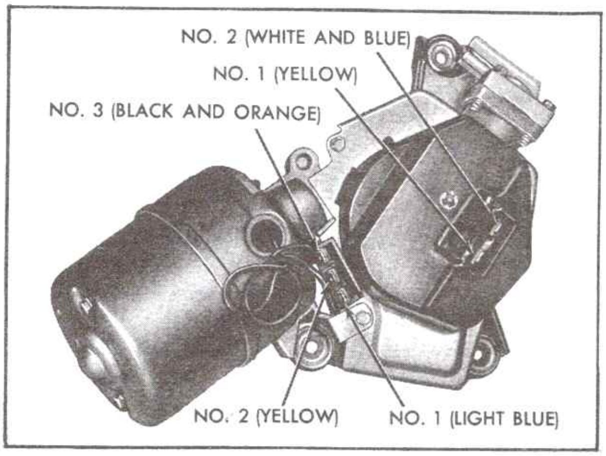


Fig. 12-32 Wiper Unit Terminals

d. To shut wiper unit off, leave jumper from No. 3 terminal connected to ground and disconnect jumper from No. 1 terminal.

NOTE: Wiper unit must always operate in "Lo" speed to park or shut off correctly.

e. Remove 12-volt supply.

3. To determine if washer unit or wiper and washer switch is defective, operate washer pump independently of switch and chassis wiring as follows:

a. Disconnect multiple connector at washer unit.

b. Operate wiper unit as described above in step 2.

c. Connect 12-volt supply to either washer pump terminal and momentarily ground other terminal with jumper wire. This will allow washer unit to operate through one cycle.

d. Remove 12-volt supply and connect multiple connectors to wiper unit and washer unit.

c. Wiper Linkage

If the wiper unit seems to be jammed and cannot turn, the trouble may be in the linkage or wiper transmissions. To check the assembly, proceed as follows:

1. Remove shroud top ventilator frame and grille, Note 34a on all but 693 styles or Note 82a on 693 styles.

2. Remove cover from opening in left side of cowl to gain access to wiper unit crank arm.

NOTE: Cover is located above wiper and washer assembly.

3. Loosen two locknuts securing wiper unit crank arm to ball socket on end of transmission drive linkage, then disengage crank arm from ball socket.

CAUTION: Do not remove locknuts from ball socket studs.

4. Manually operate the linkage and transmission assembly to check for a binding condition in the linkage or a defective transmission. If defective, service as described in Note 35 on all but 693 styles or Note 83 on 693 styles.

32. Windshield Wiper Unit Checking Procedures (On Bench)

a. Relay and Switch Assembly

1. Remove washer unit from wiper unit to gain access to relay and switch assembly.

2. Check to see that relay latch arm spring and drive pawl spring are properly connected.

3. If gear mechanism is not in full park position, manually operate relay latch arm to check that latch arm moves freely.

4. Connect a 12-volt supply to wiper unit as follows:

a. Connect positive lead to No. 2 terminal (tan lead.)

b. Connect negative lead to wiper unit housing. Do not connect jumper leads to No. 1 and No. 3 terminals.

5. Connect one lead of a test lamp to relay switch terminal to which red lead and tan lead are attached, and ground other lead to wiper housing. Failure of test lamp to light indicates defective solder connections in circuit between No. 2 terminal and relay switch terminal, or defective wiring.

6. If circuit to relay switch terminal checks out, leave 12-volt supply connected as explained in step 4, and check relay coil as follows:

a. Connect one lead of test lamp to No. 1 terminal (red lead), and ground other lead to wiper housing. Failure of test lamp to light indicates an open relay coil or a defective solder connection at No. 1 terminal. Remove test lamp.

b. Connect one end of jumper wire to No. 3 terminal (black lead), and ground other end to wiper housing. Manually push in latch arm and observe if it remains in energized position. If so, check for grounded red lead between relay coil and No. 1 terminal. If red lead is not grounded,

relay coil is grounded internally. Replace relay and switch assembly.

c. Remove jumper wire from No. 3 terminal.

7. If motor fails to shut off, disconnect 12-volt supply from wiper unit and check relay switch as follows:

NOTE: If gear mechanism is in full park position, insert a small screwdriver into switch stop slot, and push latch arm down toward relay coil. This will close relay switch points.

a. Remove a small amount of insulation from black with pink stripe lead near relay switch. Touch one lead of test lamp to exposed wire, and ground other lead to wiper housing.

b. Connect 12-volt supply to wiper unit as explained in step 4. Connect one end of jumper wire to No. 3 terminal (black lead), and ground other end to wiper housing.

c. Observe if test lamp goes out once for each revolution of gear or if lamp glows steadily. If lamp glows steadily, relay and switch contacts are not opening. Replace relay and switch assembly.

d. Remove 12-volt supply, and jumper wire from wiper unit housing. Cover exposed wire with tape.

b. Motor Checks

1. For motor checks, disassemble motor as described in Note 28a, steps 1-10 and 24.

2. Check fields for following circuit conditions:

a. Remove a small amount of insulation from black with pink stripe lead and connect a powered test lamp between exposed wire and brush holder to which internal field lead is attached. If test lamp does not light, an open series field is indicated.

b. Connect test lamp between exposed black with pink stripe lead and No. 3 terminal (black lead). If lamp does not light, an open shunt field is indicated.

c. Connect test lamp between exposed black with pink stripe lead and field laminations. If lamp lights, one of the fields is grounded.

3. Remove test lamp, cover exposed wire with tape and reassemble wiper unit as described in Note 28b, steps 2 through 14.

c. Motor Current Draw Test

1. Operate wiper unit in Lo speed as explained in Section "e" of this Note.

2. Connect an ammeter (range 0-30 amps) in series in feed wire circuit to No. 2 terminal, and observe current draw. Allow motor to run until it becomes hot.

a. If current draw is normal (3 to 5.5 amps maximum) and wiper unit cycles on and off, a weak circuit breaker is indicated. Replace brush plate assembly.

b. If current draw exceeds 5.5 amps, perform armature end-play adjustment and gear end-play adjustment as described in Section "d" of this Note. Repeat motor current draw test.

c. If armature end-play adjustment and gear end-play adjustment fail to correct excessive current draw condition, disassemble motor section of wiper unit and check armature on growler for shorted or grounded condition.

d. Wiper Unit Adjustments

1. Armature End-play Adjustment - Loosen adjusting screw locknut and adjust screw as required until end of screw just touches end of armature. Then back-off adjusting screw 1/4 turn and tighten locknut.

2. Gear End-Play Adjustment - Add or remove end-play washers as required to obtain .005 inch minimum end-play.

e. Operating Wiper Unit on Bench

After assembling wiper unit, check motor operation in the following manner. Be sure brass ground strap is connected.

a. "Lo" Speed - Connect positive lead of 12-volt supply to No. 2 terminal (tan lead) and connect negative lead to wiper unit housing. Connect jumper wires from No. 1 (red lead) and No. 3 (black lead) terminals to wiper unit housing.

b. "Hi" Speed - Remove jumper wire from No. 3 terminal.

c. "Park" or "Shut Off" - Reconnect jumper wire to No. 3 terminal and disconnect jumper wire from No. 1 terminal.

33. Windshield Wiper Arm Replacement

1. Position Windshield Wiper Arm Remover and Installer, J-8966, over lower section of arm, Fig. 12-33.

2. Press downward on tool to disengage arm assembly from transmission shaft and remove arm assembly by lifting up.

Fig. 12-33 Windshield Wiper Arm and Blade Removal

3. To install, position tool, J-8966, over lower section of arm, compress, and guide assembly on transmission shaft.

NOTE: When installing the wiper arm assemblies, be sure the left blade is above the right blade in park position, so the blades will not jam when operated.

34. Shroud Top Ventilator Frame and Grille (All Except 693)

a. Removal

1. Remove right and left windshield wiper arm and blade assemblies as described in Note 33.

2. Using Windshield Wiper Transmission Spanner Wrench, J-6592-02, remove escutcheon, spanner nut, and washer.

3. Lift escutcheon away from shroud top.

4. Raise hood and remove eight screws retaining front and side edges of ventilator frame to cowl, noting locations of any shims for installation purposes.

NOTE: Access to end screws is gained by opening door, and removing front body hinge pillar cover plates.

5. Carefully raise front edge of ventilator frame slightly and disengage washer hoses.

6. Raise rear edge of frame and slide forward to disengage frame from molding. Slide frame over windshield wiper transmission shafts and remove frame.

7. If necessary, remove three screws, flat washers and clamps that secure each grille section to under side of top shroud frame.

b. Installation

1. If removed, install three clamps, flat washers and screws that secure each grille section to underside of top shroud frame.

2. Apply medium-bodied sealer around ventilator frame screw attaching holes.

3. Position ventilator frame and, with front edge raised slightly, engage washer hoses to washer nozzle adapter.

4. Carefully slide frame rearward to engage rear edge of frame between windshield lower reveal moldings and molding attaching clips.

5. Install eight screws that secure front and side edges of frame to cowl.

6. Position escutcheon on transmission shaft, and secure with escutcheon spanner nut and washer. Tighten spanner nut using Spanner Wrench, J-6592-02.

7. Install wiper arm and blade assemblies.

IMPORTANT: When installing wiper arm and blade assemblies, be sure to "overpark" the arm and blade assemblies below the windshield so that a proper return to park position always results. Make certain left blade assembly is above the right blade assembly in park position.

35. Windshield Wiper Transmission (All Except 693)

NOTE: Windshield wiper linkage may be checked as outlined in Note 31c.

a. Removal

1. Remove shroud top ventilator frame and grille assembly, Note 34a.

2. Remove cover from opening in left side of cowl to gain access to wiper unit crank arm.

3. Loosen two retaining nuts that secure drive linkage ball socket to wiper motor crank arm, Fig. 12-24, then disengage drive linkage from crank arm ball.

CAUTION: Do not remove retaining nuts from ball socket.

4. Remove three transmission mounting attaching screws on right and left transmissions.

5. Remove four attaching screws at bell crank, then remove transmissions and linkages as a complete assembly.

b. Inspection and Overhaul

1. Inspect each ball socket for binding, damage or excessive looseness.

2. If either wiper transmission needs to be replaced, use a #10 drill to remove the two rivets holding the defective section of the linkage to its mating link ball joint. If the bell crank and drive link is to be replaced, it is necessary to remove the rivets from both joints on the bell crank.

3. Lubricate link ball carefully.

4. Assemble ball socket bearings around the link ball.

5. Secure socket bearing and link arm to bell crank with two attaching bolts from parts package. Thin socket bearing should be next to link arm. Install bolts so that screw enters from link arm side.

c. Installation

1. Position transmissions and linkages in shroud top opening and install three transmission mounting screws on left and right transmissions.

2. Install four attaching screws at bell crank.

3. Attach drive linkage ball socket to wiper crank arm ball and tighten two remaining nuts, Fig. 12-24.

4. Install cover into opening in left side of cowl.

5. Install shroud top ventilator frame and grille assembly as explained in Note 34b.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART

CONDITION	CAUSE	REMEDY
Wiper Inoperative.	No power supply at wiper.	Check circuit and chassis wiring as described in Note 31a.
	Defective dash switch.	Check dash switch mounting as described in Note 31a.
	Relay latch arm binding.	Check latch arm as described in Note 32a.
	Defective relay and switch assembly.	Check relay and switch assembly as described in Note 32a.
	Defective wiper motor.	Check motor as described in Note 32b.
Wiper Will Not Shut Off.	Defective dash switch or wiring.	Check dash switch and wiring as described in Note 31a.
	Relay latch arm binding.	Free up relay latch arm.
	Relay switch defective.	Check relay switch as described in Note 32a.
	Relay coil grounded.	Check relay coil as described in Note 32a.
	Relay latch arm spring disconnected or broken.	Connect or replace spring.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Excessive Speed in "Hi" Speed Range but Operates Normally in "Lo" Speed.	Resistor on wiper terminal board open, or rivets loose.	Replace terminal board assembly.
	Poor solder connection or defective resistor.	Solder connection or replace terminal board assembly.
Blades Do Not Park; Stop at Random.	Defective relay switch.	Replace relay and switch assembly.
Wiper Operates in "Hi" Speed Only.	Defective dash switch.	Check dash switch as described in Note 31b.
	Black with orange stripe lead between dash switch and wiper unit open.	Repair black with orange stripe lead as required.
	Defective solder connection at No. 3 terminal.	Repair as required.
	Open shunt field.	Check motor field assembly for continuity as described in Note 32b.
Wiper Operates in "Lo" Speed Only.	Defective dash switch.	Check dash switch as described in Note 31b.
	Black with orange stripe lead between dash switch and wiper unit grounded.	Check black with orange stripe lead to locate grounded condition and repair.
	Shunt field internally ground.	Check field assembly as described in Note 32b.
	Shunt field black lead to No. 3 terminal grounded.	Disassemble wiper as required to locate and repair grounded condition.
	Shorted armature.	Check armature as described in Note 32b.
Wiper Transmission Noise.	Excessive end-play in idle shaft and/or reversing link shaft.	Add end-play washers to obtain .005 inch maximum end-play.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Intermittent Operation (wiper alternately stops and starts, at 2 to 3 minute intervals).	Loose dash switch mounting.	Tighten dash switch mounting.
	Weak circuit breaker.	Check circuit breaker as described in Note 32c.
	Shorted condition in wiper motor.	Check wiper motor as described in Note 32b and c.
	Armature end-play adjustment too tight.	Check armature end-play as described in Note 32d.
	Gear end-play adjustment too tight.	Check gear end-play as described in Note 32d.
Washer Inoperative.	Damaged, kinked, torn, or disconnected washer hose, or obstruction in hose.	Repair or replace hose, or remove obstruction.
	No power supply to washer.	Check circuit from power source to washer.
	Defective dash switch.	Check dash switch as described in Note 31b.
	Defective relay coil or poor solder connections.	Replace relay coil or repair connections.
	Defective valve assembly.	Replace valve assembly.
	Washer unit mechanism binding.	Disassemble washer unit and check for bent or worn parts.
Washer Pumps Continuously When Wiper is "On".	Dash switch or wiring is grounded.	Disconnect wiring from washer pump. If washer stops, check wiring and switch.
	Relay coil grounded.	Repair or replace relay coil.
	Washer unit mechanism binding or slipping.	Disassemble washer unit and check for bent or worn parts or stripped tooth or ratchet wheel.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Delay in Water Discharge When Washer Button is Actuated.	Defective washer valve outlet assembly. Pump not holding prime.	Install new valve assembly.
Water Escapes from Washer Nozzles on Sharp Turns. Insufficient Water Spray from Washer Nozzle.	Defective washer valve outlet assembly. Defective washer valve. Loose hose connections. Partially plugged nozzles.	Install new valve assembly. Replace valve. Cut loose ends off hose and attach clean nozzles.

GENERAL DESCRIPTION

INSTRUMENT PANEL

The instrument panel for 1967 is illustrated in Fig. 12-34. The Service Information portion of this section includes procedures for the removal and installation of all components that can be considered a part of, or attached to, the instrument panel assembly used on all 1967 Cadillac cars. The procedures for actual disassembly, assembly, testing, or adjustment of the various components are covered in specific sections of this Manual where they apply.

The starter switch is combined with the ignition switch, Fig. 12-35, and is located to the right of the steering column. The engine is started by turning the key to the right against spring tension to energize the starter solenoid. When the engine starts, releasing the key permits it to return to the "ON" position. All accessories except windshield wiper and washer, and clock are disconnected while the ignition switch is turned to the extreme right for engine cranking.

The key must first be pushed in and then turned to the extreme left to permit the use of accessories with the ignition "OFF". This design prohibits the accidental engagement of the accessories position and subsequent battery discharge because the accessories are operating.

The slide out type fuse panel, Fig. 12-36, is mounted on the lower brace of the instrument panel to the left of the steering column. The following have their fuses located in this panel: antenna, rear window de-fogger, window control relay, air conditioner and heater, back-up lights, chauffer light on 697 styles, cigar lighter(s), clock, courtesy lights, glove box light, interior body lamps, map light, trunk tell-tale, horn, transmission downshift and stator control solenoids, tell-tale lights and gages, Cruise Control automatic indicator light, panel lights, radio, stop lights and hazard warning flasher, ash tray light, tail lights, turn signal and windshield wipers and washer.

On cars equipped with electric seat or windows, a 40 amp circuit breaker is provided in the fuse panel in place of the 25 amp horn fuse. On cars with heater only, a 15 amp fuse is used while a 25 amp fuse is used on Automatic Climate Control cars. The turn signal flasher is located on the fuse panel and the flasher for the Hazard Warning Flasher is located on rear side of the steering column lower cover.

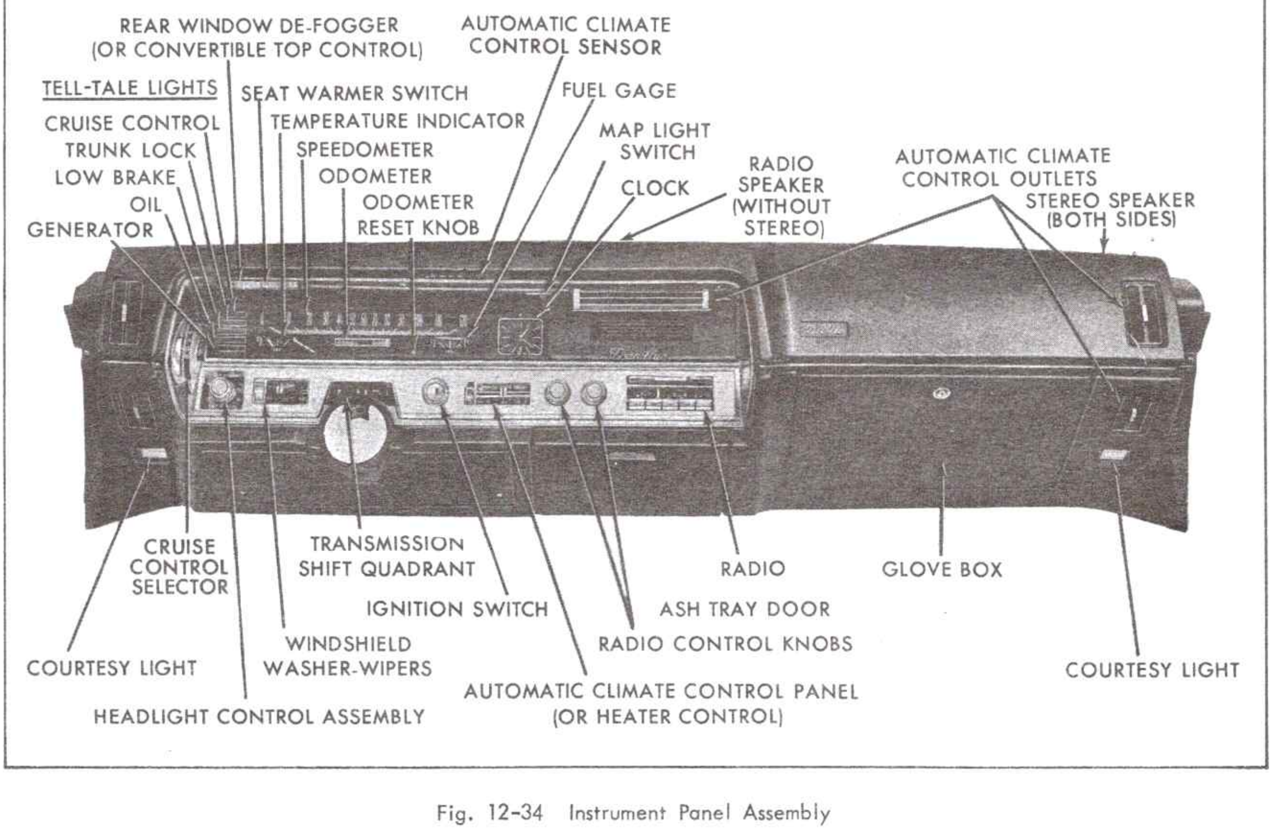


Fig. 12-34 Instrument Panel Assembly

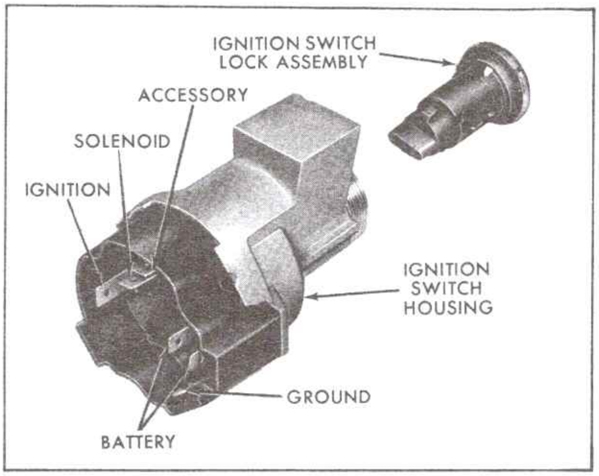


Fig. 12-35 Ignition Switch

Fusible links are placed in the power feed circuits, in the engine compartment, and are designed to open up before the instrument panel or body feed wiring, ahead of the fuse panel, is damaged in case of shorts.

The chassis wiring diagrams are illustrated at the end of this section. The major portion of the chassis wiring is divided into four separate harnesses to provide adequate fuse protection and to simplify the removal and installation for service replacement. The four harnesses are as follows:

1. Engine Primary
2. Instrument Panel
3. Under Hood
4. Generator - Regulator

The engine primary harness and the generator-regulator harness are not fused. The fuses for the other two harnesses are located in the fuse panel.

All 1967 instrument panels utilize a printed circuit on the back of the instrument panel cluster assembly. It is connected to the car wiring through a multiple terminal circuit connector which is plugged into the back side of the cluster. The printed circuit permits removal of all bulbs, sockets, fuel gage and temperature gage without any wire or terminal removal.

The only circuit in the instrument panel cluster not utilizing the printed circuit is the map light.

36. Fuse Panel Fuses

Any fuse panel fuse may be removed by first

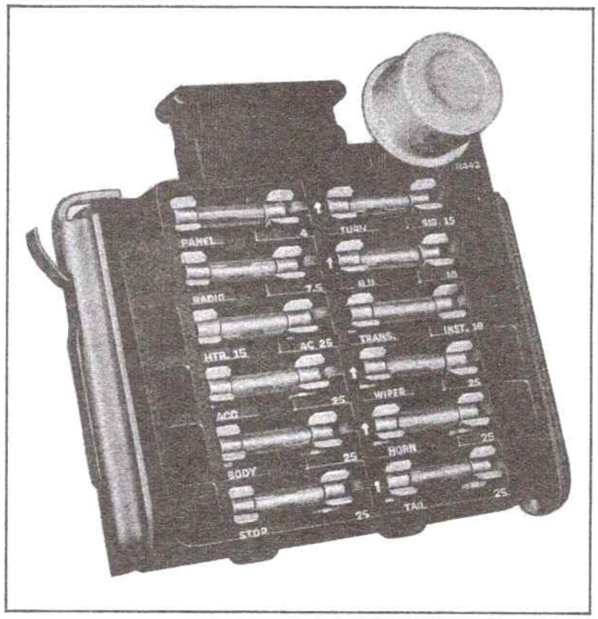


Fig. 12-36 Fuse Panel

gaining access to the fuse panel as described below and then replacing the fuse, Fig. 12-36.

1. Release spring by pulling out spring lever with finger, and slide fuse panel down far enough to permit tabs to be entirely free of locking spring.

2. Move fuse panel forward through notch in bracket and then pull panel downward as far as wires will permit. Fuse panel is now in position to be serviced.

3. Position fuse panel on bracket and push panel upward to notch in bracket and then push panel rearward.

4. Push panel upward to its stop and spring lever will lock it into position.

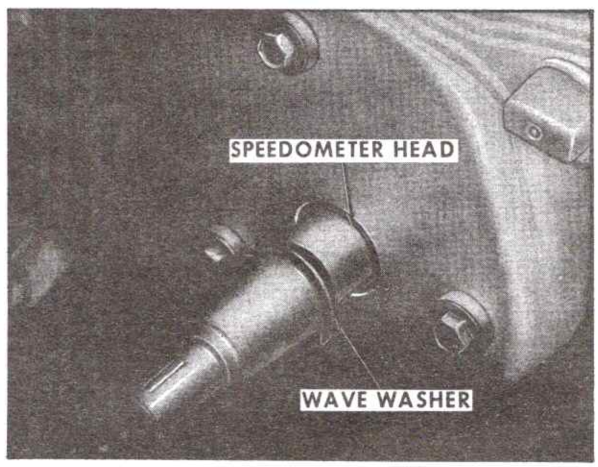


Fig. 12-37 Speedometer Cable

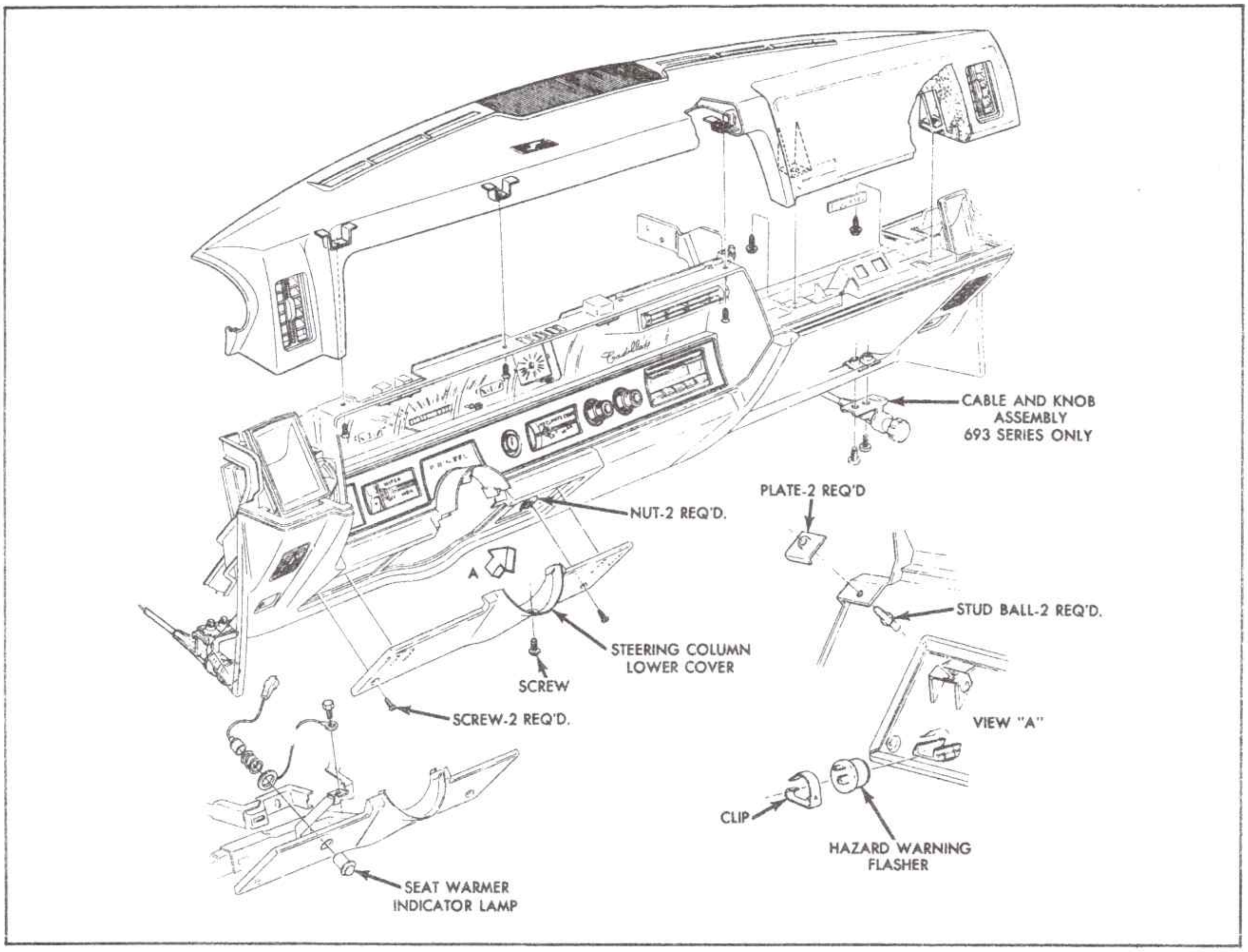


Fig. 12-38 Instrument Panel - Perspective 1

37. Upper Instrument Panel Cover (Fig. 12-38)

a. Removal

1. Disconnect negative battery cable at battery.

2. Remove three Phillips head screws securing instrument panel cluster bezel to upper cover.

3. Working inside glove box door, remove two upper screws securing upper cover to right panel.

4. Raise upper panel cover high enough for access, and disconnect the following wire connectors if car is so equipped: radio speaker or speakers. Twilight Sentinel photocell and Automatic Climate Control sensor.

5. Pull upper panel cover rearward to disengage three hooks at front of cover from retainers on cowl, and remove cover.

b. Installation

1. If car is so equipped, connect the following wire connectors: radio speaker or speakers, Twilight Sentinel photocell and Automatic Climate Control sensor.

2. Position upper panel cover on upper panel, aligning three hooks at front of cover with retainers on cowl, and engage hooks in retainers.

3. Install three Phillips head screws securing instrument panel cluster bezel to upper cover.

4. Working inside glove box door, install two upper screws.

5. Connect negative battery cable at battery.

38. Steering Column Lower Cover (Fig. 12-38)

a. Removal

1. Disconnect negative battery cable at battery.

2. On cars equipped with Tilt and Telescope steering wheel, position wheel in maximum UP position for greater accessibility.

3. Remove two Phillips head screws that hold lower end of steering column lower cover to lower instrument panel.

4. Remove one long special screw securing upper end of steering column lower cover to clamp.

5. Disengage steering column lower cover by pulling straight out to disengage two upper pins from cover and gain access to flasher unit on rear side of lower cover.

6. Remove Hazard Warning Flasher unit from mounting clip. On 697 styles equipped with seat warmer, disengage tell tale socket from cover. Remove lower cover.

b. Installation

1. Position lower cover. On 697 styles equipped with seat warmer, position spring and ground washer on socket and install into steering column lower cover. Install flasher unit on mounting clip on rear side of steering column lower cover.

2. Install steering column lower cover so that two upper pins in lower instrument panel engage lower cover.

3. Install two Phillips head screws that hold lower end of steering column lower cover to lower instrument panel.

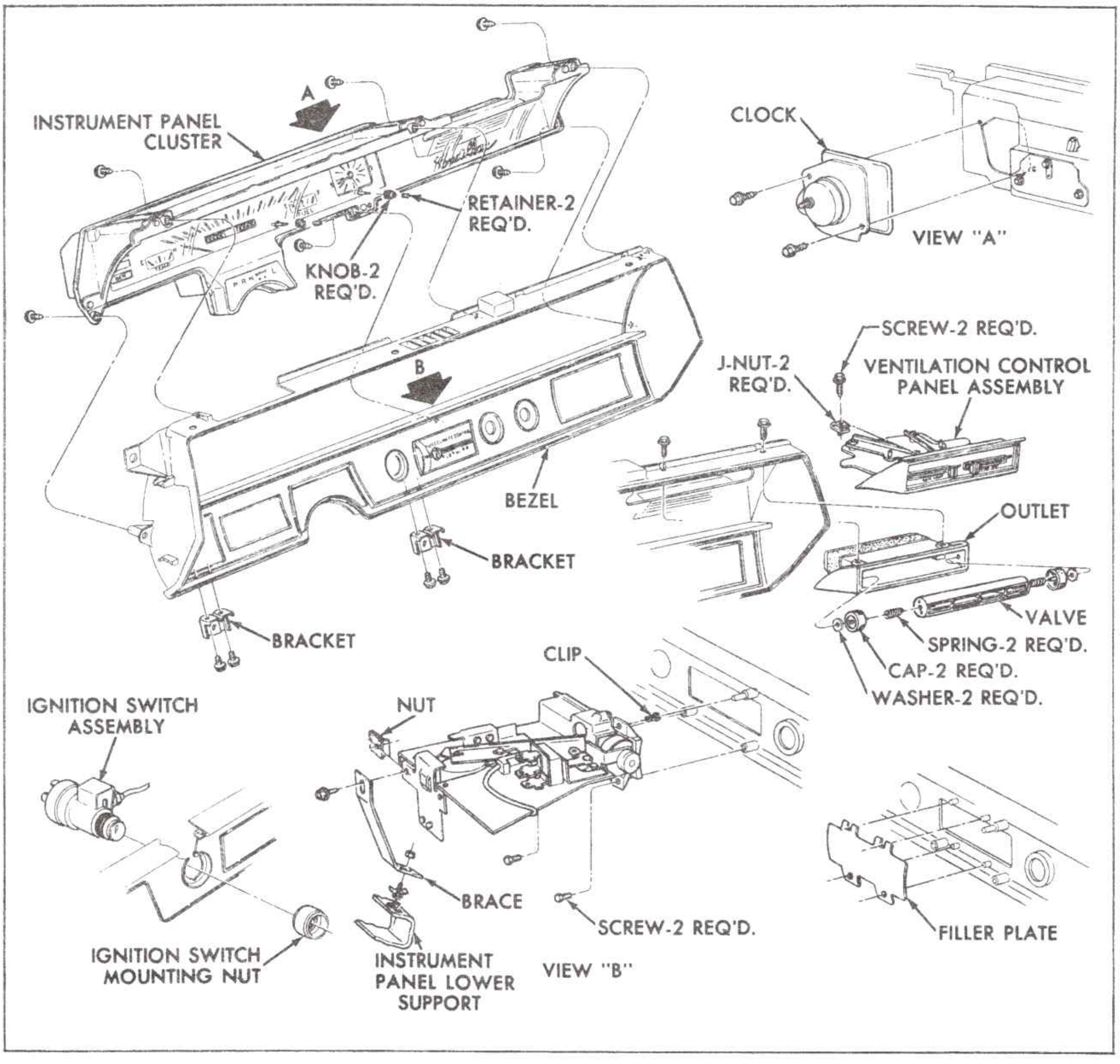


Fig. 12-39 Instrument Panel - Perspective 2

4. Install one long special screw securing lower cover to clamp.

5. Connect negative battery cable at battery.

39. Instrument Panel Cluster

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove steering column lower cover as described in Note 38a.

3. Remove transmission shift indicator pointer with an Allen wrench.

4. Disconnect multiple connector at instrument panel cluster case and remove instrument panel harness from cluster attachment.

5. Disconnect speedometer cable from speedometer head by depressing rises on wave washer, Fig. 12-37. These rises are 180° apart.

6. Remove three upper screws that secure instrument panel cluster to bezel, Fig. 12-39.

7. Remove right and center lower screws that secure instrument panel cluster to bezel. Center screw is located below clock.

8. On cars equipped with Automatic Climate Control, remove center air outlet boot at both ends and remove boot.

9. Remove two screws that secure center air outlet and remove outlet, Fig. 12-39.

10. If car is equipped with Automatic Climate Control, remove left Automatic Climate Control air outlet boot at inboard end.

11. Using a flexible hex driver, remove lower left instrument panel cluster to bezel screw, Fig. 12-39.

12. If car is equipped with Rear Window De-Fogger, Seat Warmer or convertible top, disconnect connectors.

13. Disconnect map light switch connector.

14. Loosen upper left and right bezel to bracket screws.

15. Pry left corner of bezel forward and pull instrument panel cluster up to remove.

b. Installation

1. Pry left upper corner of instrument panel cluster forward and position instrument panel cluster next to bezel.

2. Attach map light connector.

3. If car is equipped with Rear Window De-Fogger, Seat Warmer or convertible top, attach connectors.

4. Install three upper screws that secure instrument panel cluster to bezel, Fig. 12-39.

5. Install right and center lower screws that secure instrument panel cluster to bezel. Center screw is located below clock.

6. Install left lower screw that secures instrument panel cluster to bezel.

7. Connect speedometer cable at speedometer head by pushing cable on head, making sure wave washer is engaged.

8. Connect multiple connector at instrument panel cluster case. Key on connector faces up. Locate instrument panel harness on cluster and secure.

9. On cars equipped with Automatic Climate Control, install center air outlet boot at end toward cowl and connect other end at air outlet. Secure center air outlet with two screws, Fig. 12-39.

10. If car is equipped with Automatic Climate Control, install left Automatic Climate Control air outlet at inboard end.

11. Tighten upper left and right bracket to bezel screws.

12. Install transmission shift indicator pointer with an Allen wrench.

13. Install steering column lower cover as described in Note 38b.

14. Install upper instrument panel cover as described in Note 37b.

40. Speedometer Head Assembly

a. Removal

1. Remove cluster assembly as described in Note 39a.

2. Remove odometer reset knob retainer using 1/16" Allen wrench.

3. Remove clock reset knob retainer using a 1/16" Allen wrench, Fig. 12-40.

4. Remove five lower clips that hold cluster lens to cluster case.

5. Remove five upper tapping screws that hold retainer to case.

6. With back of cluster case on workbench, separate lens and retainer from cluster case.

CAUTION: Do not mark lens, tear gasket or drop out map light housing which may now be loose.

7. Remove three screws and attached grommets that hold speedometer head assembly to cluster case and place assembly with back of cluster case on workbench.

8. Separate speedometer head assembly and dust gasket from cluster case.

9. Remove map light housing as it will have to be repositioned during assembly.

b. Assembly

1. With back of cluster case on workbench, make certain two pins in high beam housing are correctly positioned in cluster case.

2. Lay tell tale housing in cluster case in approximate position with tell tale filters facing upward.

3. Position dust gasket in cluster case.

4. Install speedometer head assembly in cluster case, engaging two holes in speedometer dial with two pins in high beam housing, and positioning tell tale light housing so that two holes in speedometer dial engage tell tale housing pins.

5. Secure speedometer head assembly to speedometer case with three attaching screws and grommets, being careful to keep assembly correctly positioned so that odometer reset shaft is centered in lens hole.

6. Make certain that the paper anti-squeak gasket is correctly positioned on retainer.

7. Install map light housing in retainer.

8. Install cluster case and speedometer head assembly to retainer and lens.

9. Install five upper tapping screws that hold retainer to case.

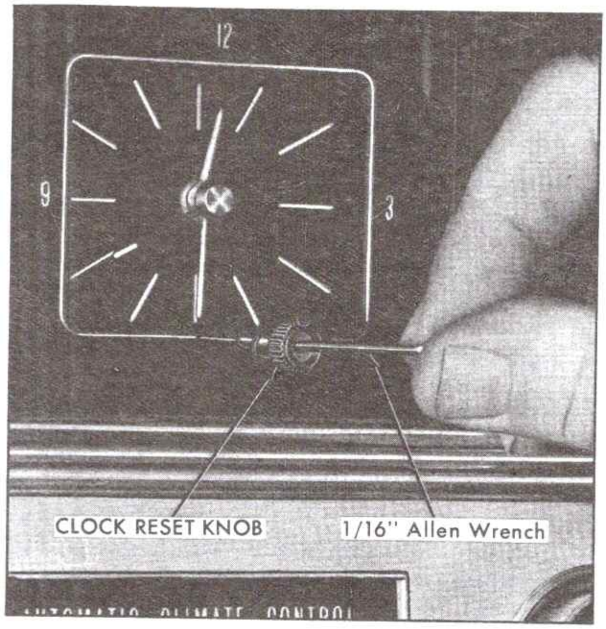


Fig. 12-40 Removing Clock Reset Knob

10. Install five lower clips that hold cluster lens to cluster case.

11. Install odometer reset knob retainer using 1/16" Allen wrench.

12. Install clock reset knob using 1/16" Allen wrench, Fig. 12-40.

13. Install cluster assembly as described in Note 39b.

41. Instrument Panel Printed Circuit (Fig. 12-17)

a. Removal

1. Remove instrument panel cluster assembly as described in Note 39a.

2. Remove one nut and wave washer securing printed circuit to clock.

3. Remove 12 wedge base sockets and bulbs from cluster case.

4. Remove two screws at fuel gage.

5. Remove two screws at temperature gage.

6. Remove four screws that secure printed circuit to cluster case and remove printed circuit.

NOTE: No attempt should be made to repair this circuit. If inoperative it should be replaced.

b. Installation

1. Position printed circuit over two high beam tell-tale housing pins on back of cluster case.

2. Install 12 wedge base sockets and bulbs at cluster case.

3. Install four self-tapping screws that secure printed circuit to cluster case.

4. Secure temperature gage with two screws.

5. Secure fuel gage with two screws.

6. Install one nut and wave washer securing printed circuit to clock.

7. Install instrument panel cluster assembly as described in Note 39b.

42. Clock Assembly

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove set screw securing clock reset knob, using 1/16" Allen wrench, Fig. 12-40.

3. Remove wedge base clock bulb.

4. Remove plastic protective cover and one nut and washer securing printed circuit flap to rear of clock.

5. Remove two screws securing clock assembly to back of cluster case, Fig. 12-39. Position printed circuit back out of way. Remove clock assembly by sliding to right side and removing left side first.

CAUTION: Use care to prevent damage to second hand.

b. Installation

1. Position printed circuit. Position clock assembly on back of cluster case by sliding in from right side and secure with two screws, Fig. 12-39.

2. Position printed circuit flap on clock and secure with nut, washer and plastic protective cover.

3. Position printed circuit and install wedge base clock bulb.

4. Install set screw securing clock reset knob using 1/16" Allen wrench, Fig. 12-40.

5. Install upper instrument panel cover as described in Note 37b.

43. Headlight Control Switch Assembly

a. Removal

1. Remove steering column lower cover as described in Note 38a.

2. On 693 style, remove hoses at vacuum valve, which is integral with headlight valve.

3. Remove lower right screw securing headlight control switch housing to lower instrument panel, Fig. 12-41.

NOTE: This screw has a special 3/4" head and may be removed with a 1/4" socket.

4. In cars equipped with Automatic Climate Control, remove left outlet hose at inboard side to gain access to upper left screw.

5. Remove upper left screw securing headlight control switch housing to lower instrument panel, Fig. 12-41.

NOTE: This screw has a special 3/4" head and may be removed with a 1/4" socket.

6. Pull headlight control switch assembly rearward, disconnect wiring harness connectors, two bulbs and remove assembly.

b. Installation

1. Position headlight control switch assembly and connect three wiring harness connectors and install two bulbs.

2. Position headlight control switch housing on lower instrument panel and install lower right special screw with 3/4" head, Fig. 12-41.

3. Install special screw with 3/4" long head securing upper left corner of headlight control switch housing to lower instrument panel, Fig. 12-41.

4. On cars equipped with Automatic Climate Control, install left outlet hose at inboard side.

5. On 693 style, connect hoses at vacuum valve.

6. Install steering column lower cover as described in Note 38b.

44. Headlight Switch (Fig. 12-41)

a. Removal

1. Remove headlight control switch assembly as described in Note 43a.

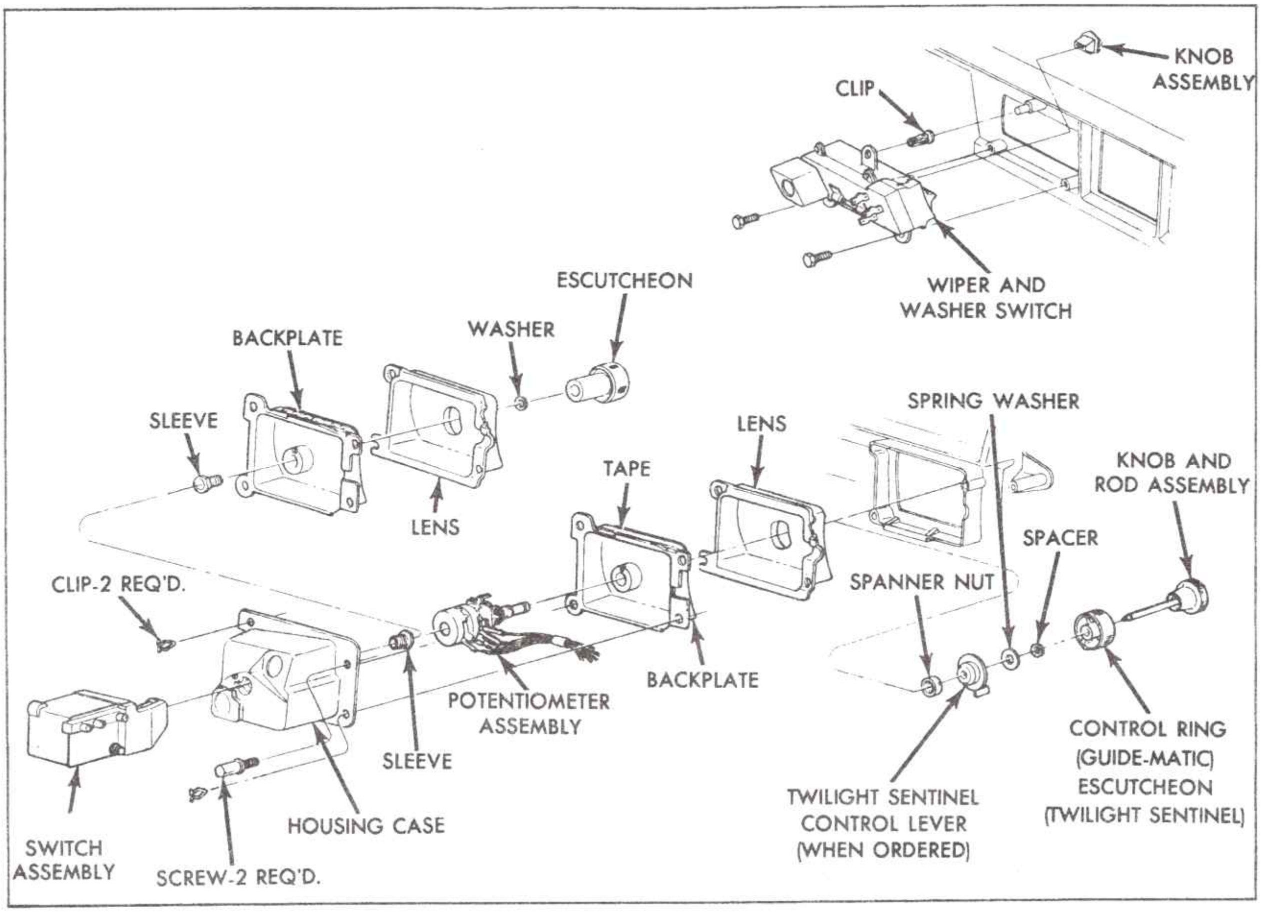


Fig. 12-41 Instrument Panel - Perspective 3

2. Depress spring-loaded release button on bottom of headlight switch and remove headlight switch knob and rod assembly.

3. Remove two clips that secure housing case to backplate and lens and separate case and headlight switch assembly.

4. Remove hex head sleeve securing headlight switch to housing case and remove switch from case.

b. Installation

1. Install headlight switch on headlight control switch housing case, aligning tang on switch with locating notch in housing case.

2. Install hex head sleeve securing headlight switch to housing case.

CAUTION: Be sure that tang on headlight switch is aligned with locating notch in housing before tightening hex head sleeve.

3. Install housing case and headlight switch assembly on backplate and lens and secure with clip at left lower and right upper corners.

NOTE: On cars equipped with Guide-Matic and/or Twilight Sentinel, control switch wires must be positioned in notch in backplate.

4. Depress spring-loaded release button on bottom of headlight switch and insert headlight switch knob and rod assembly into headlight switch. When knob and rod assembly is fully in, release lock button to lock in place.

5. Install headlight control switch assembly as described in Note 43b.

45. Headlight Switch Housing—Without Guide-Matic and/or Twilight Sentinel (Fig. 12-41)

a. Disassembly

1. Remove headlight control switch assembly as described in Note 43a.

2. Depress spring-loaded release button on bottom of headlight switch and remove headlight switch knob and rod assembly.

3. Remove two clips that secure housing case to backplate and lens and separate case and headlight switch assembly.

4. Remove hex head sleeve securing backplate to lens, washer and escutcheon and separate these parts.

b. Assembly

1. Position lens, washer and escutcheon on backplate and secure with hex head sleeve.

2. Install case and headlight switch assembly on backplate and secure with hex head sleeve.

3. Install housing case and headlight switch assembly on backplate and lens and secure with clip at left lower and right upper corners.

4. Depress spring-loaded release button on bottom of headlight switch and insert headlight switch knob and rod assembly into headlight switch. When shaft and knob assembly is fully in, release lock button to lock in place.

5. Install headlight control switch assembly as described in Note 43b.

46. Guide-Matic or Twilight Sentinel Control Switch (Fig. 12-41)

NOTE: On cars equipped with both options, a dual control switch with an inner and outer shaft is used.

a. Removal

1. Remove headlight control switch assembly as described in Note 43a.

2. Depress spring-loaded release button on bottom of headlight switch and remove headlight switch knob and rod assembly from headlight switch.

3. Remove two clips that secure housing case to backplate and lens and separate backplate and lens.

4. Remove spring-loaded control ring and spacer (Guide-Matic) or spring-loaded escutcheon, spacer, spring washer and control lever (Twilight Sentinel) from end of control switch shaft.

NOTE: On cars equipped with both options, remove Guide-Matic spring-loaded control ring, spacer, and spring washer from dual control switch inner shaft and Twilight Sentinel control lever from outer shaft.

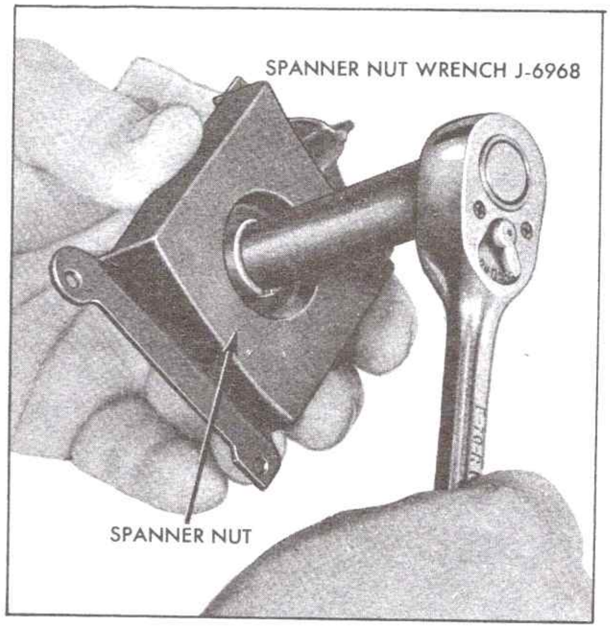


Fig. 12-42 Removing Spanner Nut

5. Remove spanner nut securing control switch to backplate using Spanner Nut Wrench, J-6968, Fig. 12-42, and remove control switch from back plate.

b. Installation (With Guide-Matic and/or Twilight Sentinel)

1. Install control switch on backplate, aligning notch in backplate with tang on control switch. Secure with spanner nut using Spanner Nut Wrench, J-6968, Fig. 12-42.

2. Install control lever, spring washer, spacer and spring-loaded escutcheon (Twilight Sentinel) or spacer and spring-loaded control ring (Guide-Matic) on control switch shaft.

NOTE: On cars equipped with both options, install Twilight Sentinel Control lever on dual control switch outer shaft and spring washer, spacer, and Guide-Matic spring-loaded control ring on inner shaft.

3. Install housing case and headlight switch assembly on backplate and lens, positioning control switch wires in notch on backplate. Secure with clip at left lower and right upper corners.

4. Depress spring-loaded release button on bottom of headlight switch and insert headlight switch operating knob and rod assembly into headlight switch. When knob and rod assembly is fully in, release lock button to lock in place.

5. Install headlight control switch assembly as described in Note 43b.

47. Fuel Gage

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove two screws securing fuel gage to back of cluster case.

b. Installation

1. Position printed circuit and install fuel gage on back of cluster case, securing with two screws.

2. Install upper instrument panel cover as described in Note 37b.

48. Temperature Gage

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove two screws securing temperature gage to back of cluster case.

b. Installation

1. Position printed circuit and install temperature gage on back of cluster case, securing with two screws.

2. Install upper instrument panel cover as described in Note 37b.

49. Ignition Switch

a. Removal

1. Remove steering column lower cover as described in Note 38a.

2. Remove ignition switch lock cylinder from switch housing, using a .035 inch diameter wire (paper clip) to depress tumbler pin while turning ignition key to the left from accessory position, and pulling outward.

3. Disconnect connector at rear of ignition switch housing.

4. Remove ignition switch mounting nut, using Ignition Switch Wrench, J-22547, Fig. 12-43.

5. Disconnect dial bulb socket at rear of ignition housing and remove switch through rear of instrument panel.

b. Installation

1. Connect dial bulb socket to rear of switch housing.

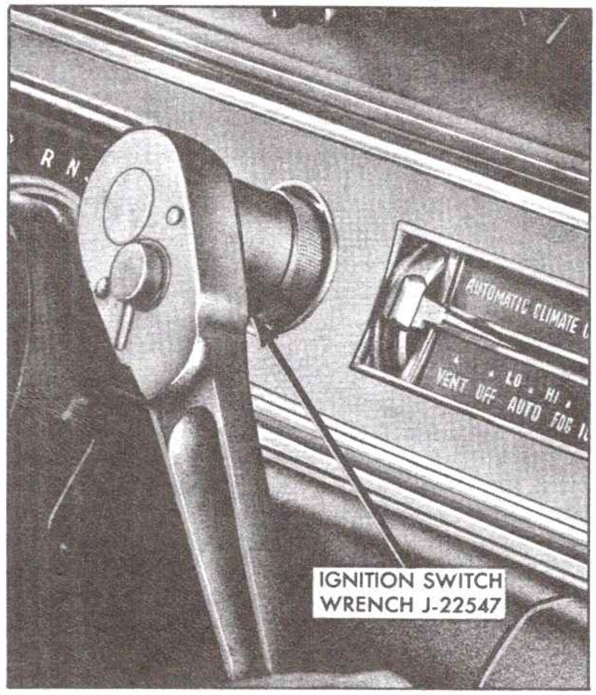


Fig. 12-43 Removing Ignition Switch

2. Insert ignition switch into instrument panel from rear.

3. Install spanner nut on switch housing and tighten securely, using Ignition Switch Wrench, J-22547, Fig. 12-43.

4. Connect connector to rear of switch housing.

5. Install ignition switch lock assembly in switch housing and turn key to the right to secure lock assembly to housing.

6. Install steering column lower cover as described in Note 38b.

50. Radio Receiver Unit

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove ash tray housing assembly as described in Note 54a.

3. Remove four screws and lockwashers that secure ash tray frame to retaining plate, Fig. 12-44.

4. Disconnect ash tray frame multiple connector and remove frame.

5. Remove radio knobs, springs and rings, using an Allen wrench to loosen knob retainer screws.

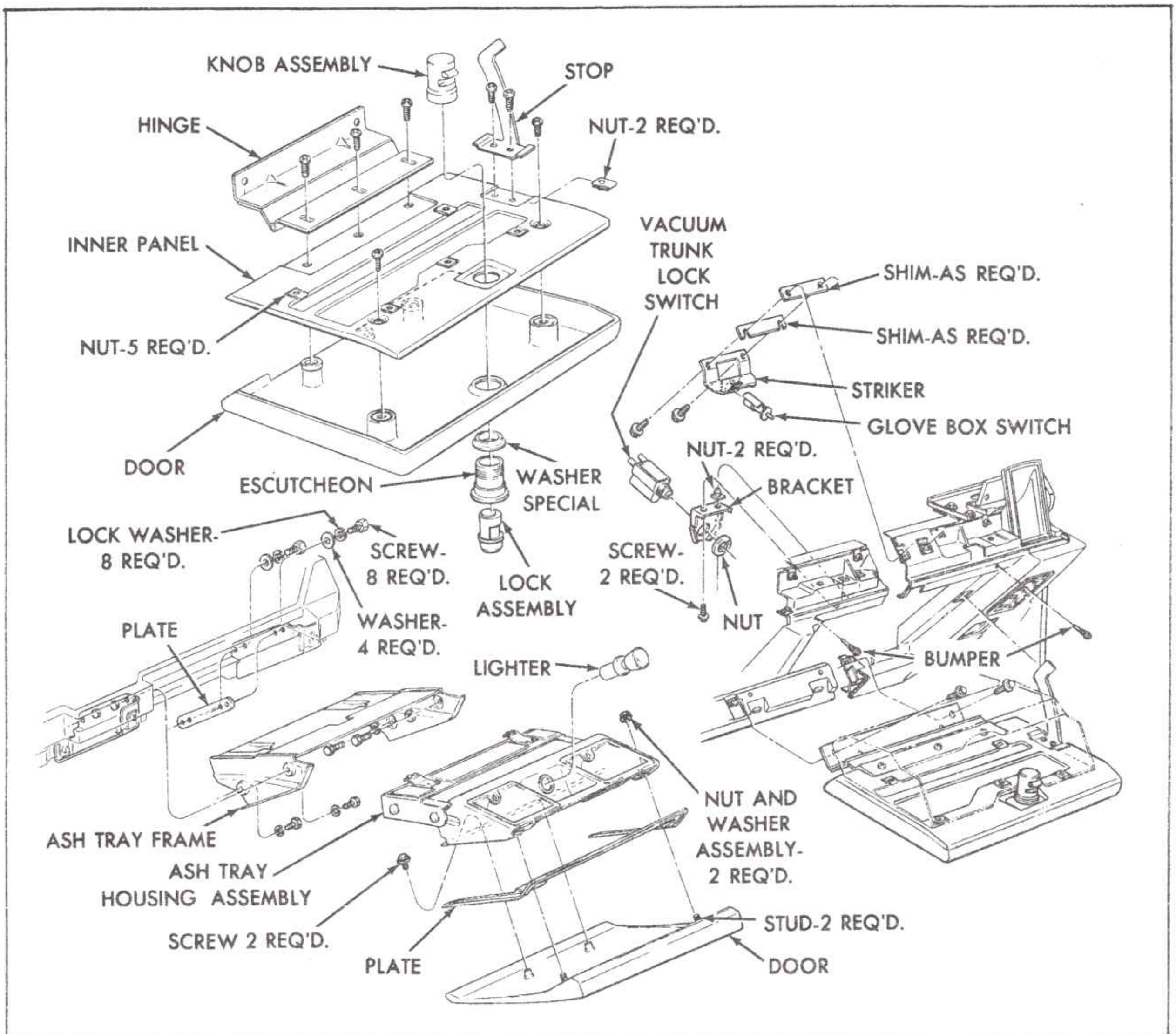


Fig. 12-44 Instrument Panel - Perspective 4

6. Using Spanner Nut Wrench J-6968, remove spanner nuts that hold control shafts to instrument panel, Fig. 12-45.

7. Remove screw on right side that secures radio bracket to frame.

8. Carefully pull radio rearward to disengage control shafts and drop radio slightly to gain access to wiring connectors.

9. On AM/FM Stereo radio disconnect audio-amplifier unit connector.

10. Disconnect antenna lead-in cable and connector at radio.

11. Disconnect dial bulb socket from radio.

12. Disconnect foot control cable plug from radio if car is so equipped.

13. On stereo radio, remove tape securing speaker leads: Two pieces on instrument panel cluster and two pieces at instrument panel frame above glove box door.

14. Remove radio by pulling through ash tray housing hole.

b. Installation

1. Position radio in ash tray housing hole.

2. Connect foot control cable to radio, if car is so equipped.

3. Connect dial bulb socket to radio.

4. Connect antenna lead-in cable and five-way connector to radio.

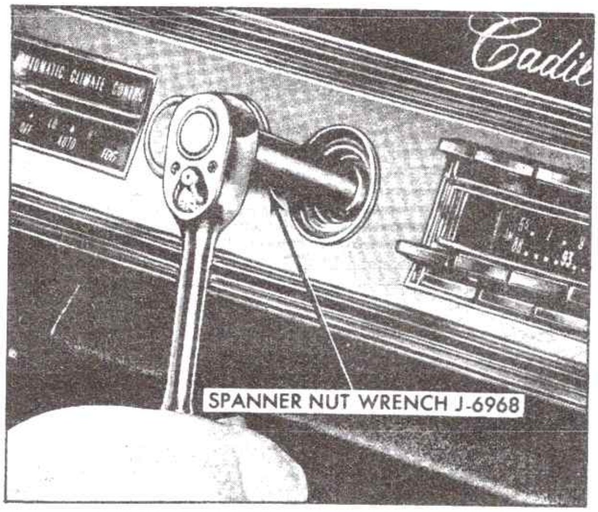


Fig. 12-45 Removing Radio Control Knob Nut

5. On AM/FM stereo radio, connect audio-amplifier unit connector.

6. Install radio on panel, being careful not to damage control ferrule threads.

7. Loosely install spanner nuts that hold control shafts to panel to hold radio in position, Fig. 12-44.

8. Align radio and tighten screw securing right rear side bracket to frame, Fig. 12-44.

9. Tighten spanner nuts that hold control shafts to panel using Spanner Nut Wrench J-6968, Fig. 12-45.

10. Install rings, springs and knobs on control shafts and tighten knobs securely, using an Allen wrench.

NOTE: The manual selector knob (right knob) should be installed all the way on the shaft to allow for antenna operation.

11. Connect ash tray frame multiple connector.

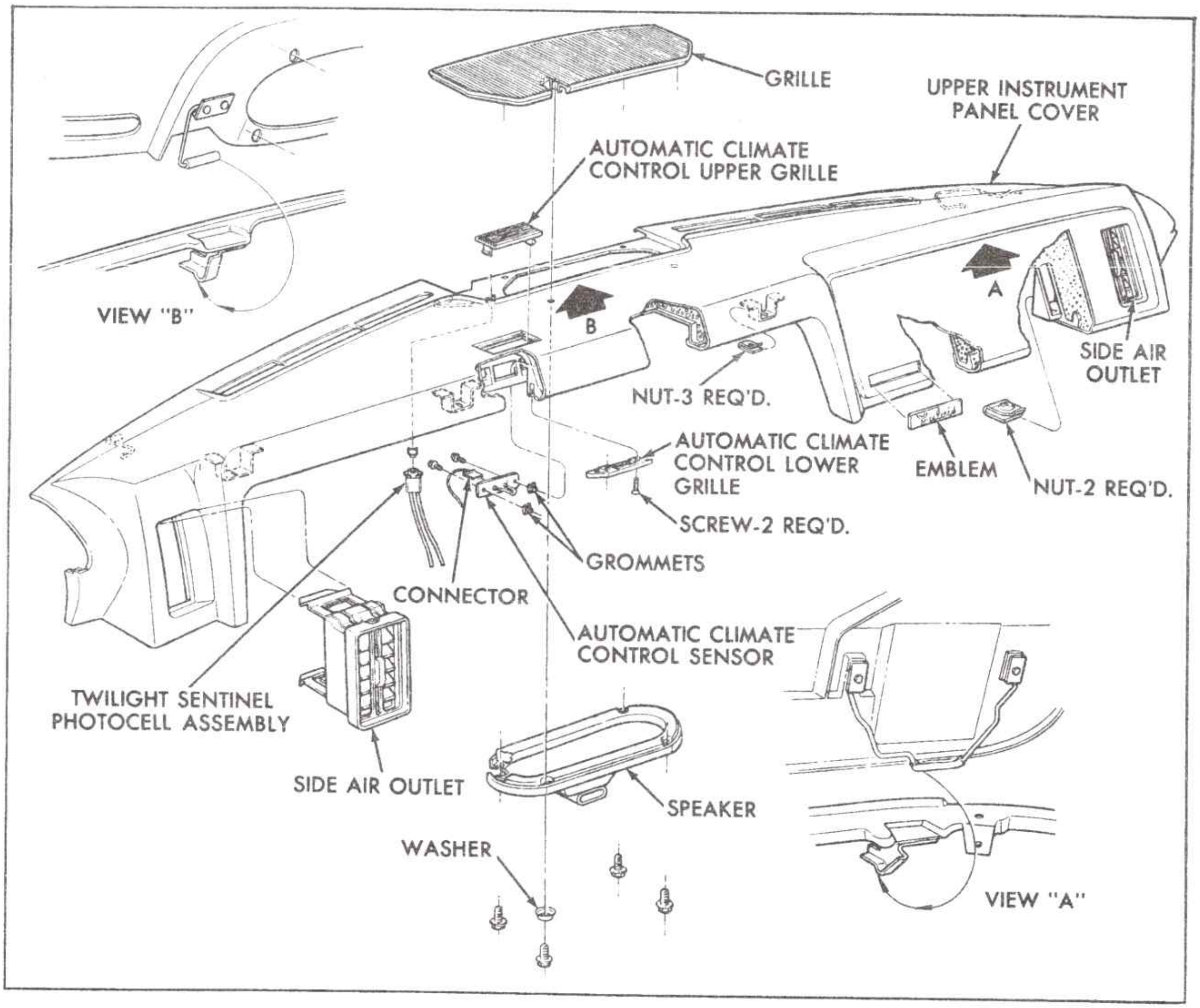


Fig. 12-46 Instrument Panel - Perspective 5

12. Install ash tray frame and secure with four lockwashers and screws.

13. Install ash tray housing assembly as described in Note 54b.

14. On stereo radios, secure four pieces of tape securing speaker leads: two at instrument panel cluster and two at instrument panel frame above glove box door.

15. Install upper instrument panel cover as described in Note 37b.

51. Audio Amplifier Unit

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove audio amplifier unit connector at receiver unit.

3. Remove three screws that secure audio amplifier unit to instrument panel and one screw that secures it to side brace.

b. Installation

1. Position audio amplifier unit on instrument panel and secure with three screws and one screw at side brace.

NOTE: On 693 styles, the right screw also secures a bracket.

2. Connect audio amplifier unit connector at receiver unit.

3. Install upper instrument panel cover as described in Note 37b.

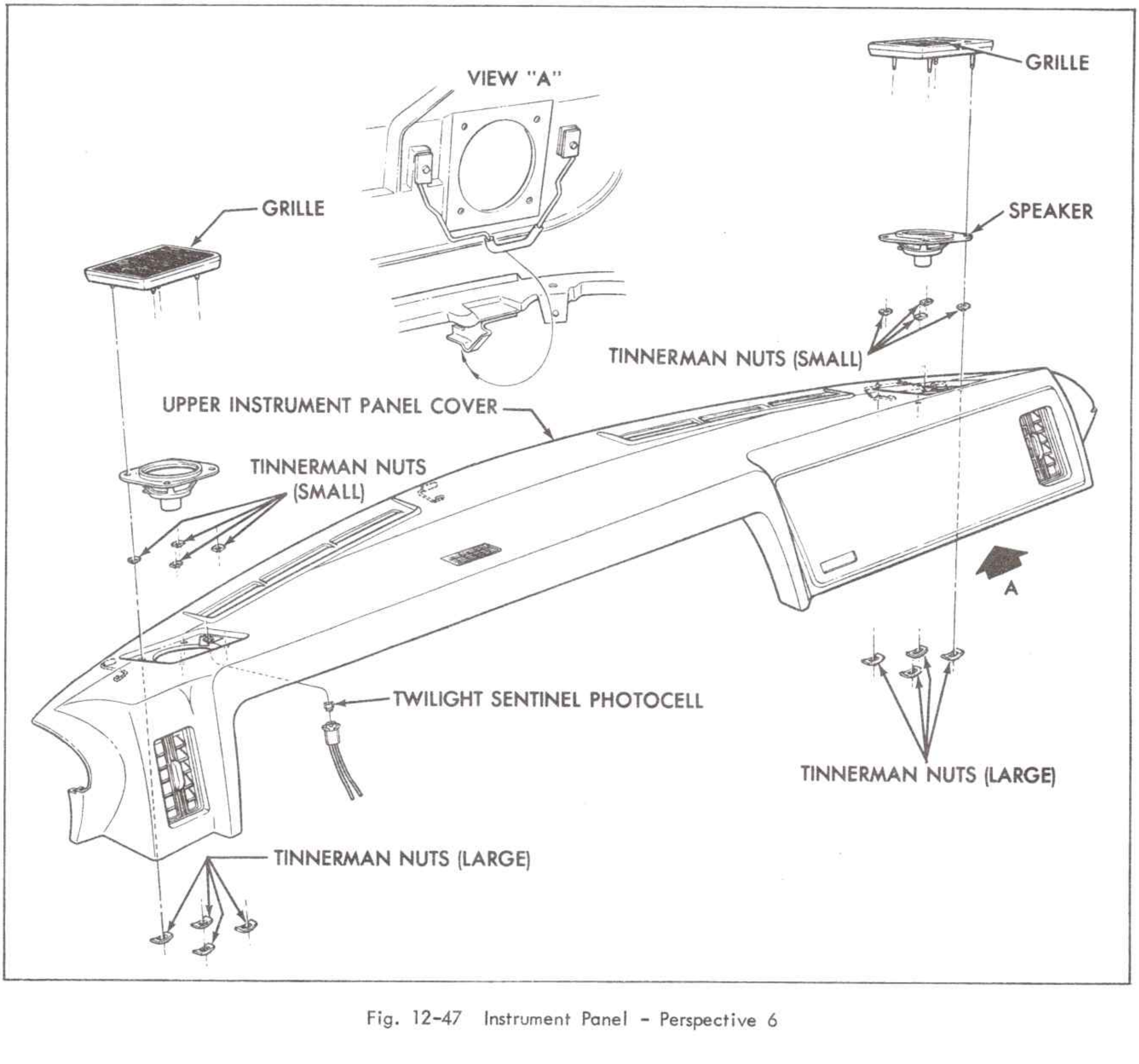


Fig. 12-47 Instrument Panel - Perspective 6

52. Radio Front Speaker

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. On all but AM/FM-Stereo radios, remove four screws and one washer that hold radio front center speaker to grille and remove front speaker, Fig. 12-46.

3. Remove either AM/FM-Stereo radio front speaker by removing four larger nuts that secure speaker and grille to upper instrument panel cover, Fig. 12-47. Remove grille and speaker. Separate speaker from grille by removing four smaller nuts.

b. Installation

1. On all but AM/FM-Stereo radios, position front center speaker on upper instrument panel cover and grille. Secure with four screws and one washer. Washer goes at left front mounting screw, Fig. 12-46.

2. On either AM/FM-Stereo radio front speaker secure speaker to grille with four smaller tinnerman nuts, Fig. 12-47. Secure speaker and grille to upper instrument panel cover with four larger tinnerman nuts.

3. Install upper instrument panel cover as described in Note 37b.

53. Cigar Lighter Base Assembly

a. Removal

1. Remove ash tray housing assembly as described in Note 54a.

2. Open ash tray housing door and remove cigar lighter and two ash tray receptacles.

3. Remove two nuts and two screws with flat washers that secure ash tray housing to plate and door and separate housing.

4. Disconnect ash tray housing bulb socket from shield and cigar lighter base feed wire from cigar lighter base.

5. Remove sleeve from lighter base by holding base with index finger while rotating sleeve.

6. Remove lighter base from ash tray housing.

b. Installation

1. Position cigar lighter base in ash tray housing.

2. Hold lighter base in position with index finger and screw sleeve on base. Bulb shield must face up when tight to permit light to enter ash tray receptacles.

3. Connect ash tray housing bulb socket to shield and feed wire to cigar lighter base.

4. Position plate and ash tray housing on door and secure with two nuts and two screws with flat washers.

5. Insert two ash tray receptacles and cigar lighter into ash tray housing.

6. Install ash tray housing assembly as described in Note 54b.

54. Ash Tray Housing Assembly

a. Removal

1. Open ash tray housing door.

2. Using a screwdriver with a long shaft pry two retainer brackets free. Remove ash tray housing.

b. Installation

1. Install ash tray housing assembly by positioning assembly in instrument panel opening and pushing on assembly to engage two retainer brackets.

55. Windshield Wiper and Washer Switch

a. Removal

1. Remove steering column lower cover as described in Note 38a.

2. Remove two screws and clip securing switch assembly to panel, Fig. 12-41.

3. Pull switch rearward to disengage from instrument panel.

4. Disconnect dial bulb socket and wiring harness connector from back of switch assembly.

b. Installation

1. Position switch assembly and connect harness connector and dial bulb socket to back of wiper and washer switch.

2. Position switch assembly on lower instrument panel engaging stud with hole in switch assembly.

3. Secure switch assembly to lower instrument panel with clip and two screws, Fig. 12-41.

4. Install steering column lower cover as described in Note 38b.

56. Ventilation Control Panel Assembly

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove clip washers that hold bowden cables on control lever pins.

3. Loosen bowden cable clamp screws and disconnect cables from control lever pins and cable clamps.

4. Remove two screws that hold ventilation control panel assembly to instrument panel cluster bezel and remove control panel assembly, Fig. 12-39.

b. Installation

1. Install ventilation control panel assembly on instrument panel cluster bezel. Position two J-nuts and secure with two screws, Fig. 12-39.

2. Install bowden cables on lever pins and secure with clip washers.

3. Install bowden cables in cable clamps and tighten screws that hold cables to clamps.

4. Adjust ventilation control cables as described in Section 1, Note 1b.

5. Install upper instrument panel cover as described in Note 37b.

57. Heater Control Panel Assembly

a. Removal

1. Remove steering column lower cover as described in Note 38a.

2. Remove six port vacuum connector from bottom of heater control panel assembly.

3. Remove two-way switch connector and dial bulb socket from bottom of assembly.

4. Remove two screws and clip that secure assembly to lower instrument panel.

5. Pull assembly toward cowl and disconnect dial bulb socket and four-way switch connector from top of assembly.

6. Remove assembly from beneath lower instrument panel cover.

b. Installation

1. Position heater control panel assembly and connect dial bulb socket and one four-way switch connector at top.

2. Install assembly on lower instrument panel engaging hole with stud. Secure with two screws and clip.

3. Connect two-way switch connector and dial bulb socket at bottom of assembly.

4. Install six port vacuum connector at bottom of assembly.

5. Install steering column lower cover as described in Note 38b.

58. Automatic Climate Control Panel Assembly

a. Removal

1. Remove steering column lower cover as described in Note 38a.

2. Remove seven port vacuum connector from bottom of Automatic Climate Control panel assembly.

3. Disconnect three wiring connectors and dial bulb socket from bottom of Automatic Climate Control panel assembly.

4. Remove two screws and clip that secure assembly to lower instrument panel, Fig. 12-39, and one screw that secures assembly to brace.

5. Pull assembly toward cowl and disconnect dial bulb socket and one wiring harness connector from top of assembly.

6. Remove assembly from beneath lower instrument panel cover.

b. Installation

1. Position Automatic Climate Control panel assembly and connect dial bulb socket and one wire harness connector at top.

2. Install assembly on lower instrument panel engaging hole with stud. Secure with two screws and clip, Fig. 12-39. Position nut and secure brace to assembly with one screw.

3. Connect three wiring connectors and dial bulb socket at bottom of assembly.

4. Install seven port vacuum connector at bottom of assembly.

5. Install steering column lower cover as described in Note 38b.

59. Automatic Climate Control Sensor (In-Car)

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove two screws and plastic grommets that secure Automatic Climate Control sensor unit to upper instrument panel cover and remove sensor, Fig. 12-46.

b. Installation

1. Install Automatic Climate Control sensor unit on underside of upper instrument panel cover and secure with two screws and plastic grommets, Fig. 12-46.

2. Install upper instrument panel cover as described in Note 37b.

60. Automatic Climate Control Side Air Outlet

a. Removal

1. Remove Automatic Climate Control side air outlet from instrument panel by grasping outlet with thumb and forefinger and pulling straight out.

b. Installation

1. Press side air outlet into opening in instrument panel.

NOTE: The upper outlets should be installed so that the valves will close when they are down and lower outlet valve should close when they are up.

61. Automatic Climate Control Center Air Outlet

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Remove two screws securing Automatic Climate Control center air outlet to bezel and pull slightly forward. Disconnect boot and remove center air outlet.

3. If necessary, valve may be removed by pushing both caps inward and pulling caps forward to remove. Separate two washers, caps and springs from louvers.

b. Installation

1. If removed, install washers on outboard side of caps and springs on inboard side of valve. Push both caps inward and install into outlet.

2. Insert Automatic Climate Control center air outlet into boot and secure to bezel with two screws.

3. Install upper instrument panel cover as described in Note 37b.

62. Compressor Diode Assembly (697 Styles Only)

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Disconnect multiple connector at compressor diode assembly.

3. Remove one self-tapping screw that secures compressor diode bracket to instrument panel bracket and remove assembly with bracket attached.

4. Separate bracket from assembly by removing two bolts.

b. Installation

1. Secure bracket to compressor diode assembly with two bolts.

2. Position compressor diode bracket on instrument panel bracket and secure with one self-tapping screw.

3. Connect multiple connector at compressor diode assembly.

4. Install upper instrument panel cover as described in Note 37b.

63. Glove Box Liner

a. Removal

1. Open glove box door and remove five screws that hold glove box liner to glove box door.

2. Remove two screws that secure glove box door stop to door and remove stop, Fig. 12-44.

3. Remove two screws that hold vacuum trunk lock bracket, if car is so equipped, Fig. 12-44.

4. Remove glove box liner.

b. Installation

1. Install glove box liner into glove box opening.

2. Install vacuum trunk lock switch bracket and secure with two attaching screws, if car is so equipped, Fig. 12-44.

3. Install glove box door stop engaging hook and secure with two attaching screws, Fig. 12-44.

4. Align glove box liner with glove box door and secure liner to door with five attaching screws.

64. Glove Box Door

a. Removal

1. Remove glove box liner as described in Note 63a.

2. Remove three screws that hold glove box door to glove box door hinge and bracket and remove door, Fig. 12-44.

b. Installation

1. Install glove box door on glove box hinge and bracket and secure with three attaching screws, Fig. 12-44.

2. Install glove box liner as described in Note 63b.

65. Cruise Control Selector Assembly

a. Removal

1. Disconnect negative battery cable at battery.

2. Release retainer spring from dust shield by turning 90 degrees and slide it back on control cable. Pull control cable to release from adjustable coupling.

3. Attach a five-foot piece of wire or heavy string to disconnected end of control cable.

NOTE: Attaching the wire or string to end of control cable will insure cable being routed properly when selector control assembly is reinstalled.

4. Remove upper instrument panel cover as described in Note 38a.

5. Remove steering column lower cover as described in Note 39a.

6. Disconnect two wiring connectors at selector control assembly.

7. Rotate both spring clamps forward by inserting any hook-shaped tool in clamp. Selector control assembly will now be free from instrument panel bezel.

8. Remove top screw and loosen lower screw securing grommet retainer to firewall and remove split grommet.

9. Pull control cable through firewall from inside car with selector control assembly, being careful not to bend or kink cable.

10. Remove string or wire from end of control cable and leave in grommet retainer.

11. If necessary, control cable may be adjusted as described in Section 15, Note 18.

b. Installation

1. Attach wire or heavy string, left in grommet retainer during removal procedure, to end of control cable inside car.

2. Working from outside car, pull on wire or string to guide control cable through retainer, being careful not to bend or kink control cable.

3. Install split grommet in retainer and install top screw and tighten lower screw securing grommet retainer to firewall.

4. Position selector control assembly on instrument panel bezel and engage by rotating both spring clamps.

5. Connect two wiring connectors at selector control assembly.

6. Install steering column lower cover as described in Note 38b.

7. Install upper instrument panel cover as described in Note 37b.

8. Remove wire or string from end of control cable.

9. Rotate speed selector to high speed setting and guide cable into dust shield until ferrule stops against dust shield. Hold in this position and rotate retainer spring on dust shield so that it engages ferrule through slots.

10. Rotate selector dial to low speed stop until spring snaps into adjustable coupling.

CAUTION: This step must be performed or unit will control in "ON" position or lock-in in "AUTO" position at low speed regardless of selected setting.

11. Connect negative battery cable at battery.

66. Twilight Sentinel Photocell

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Rotate plastic photocell holder counterclockwise to remove from underside of upper instrument panel cover.

3. Remove photocell from plastic holder.

b. Installation

1. Insert photocell in plastic photocell holder.

2. Install plastic holder into underside of upper instrument panel cover by rotating clockwise.

3. Install upper instrument panel cover as described in Note 37b.

67. Twilight Sentinel Amplifier

a. Removal

1. Working to right of radio receiver unit, remove two screws that hold amplifier unit to lower instrument panel bracket and remove amplifier from bracket to gain access to multiple electrical connector.

2. Disconnect multiple electrical connector from amplifier and remove amplifier.

b. Installation

1. Connect multiple electrical connector to amplifier unit.

2. Install amplifier on lower instrument panel bracket and secure with two attaching screws.

3. Check operation of the Twilight Sentinel.

68. Rear Window De-Fogger Blower Switch

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Slide out fuse panel as described in Note 36.

3. Disconnect blower switch single connector (light green wire) at accessory terminal on fuse panel.

4. Disconnect blower switch tee connector (yellow and brown wires) from wire assembly connector.

5. Remove two screws securing blower switch to instrument panel cluster bezel and remove switch.

b. Installation

1. Route blower switch single connector (light green wire) behind instrument panel cluster case and attach at accessory feed terminal on fuse panel. Slide fuse panel up to secure.

2. Connect blower switch tee connector (yellow and brown wires) to wire assembly connector.

3. Install blower switch on instrument panel cluster bezel, position two jamb nuts, and secure with two screws.

4. Install upper instrument panel cover as described in Note 37b.

69. Convertible Top Switch

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Detach switch connector.

3. Remove two screws securing convertible top switch to instrument panel cluster bezel and remove switch.

b. Installation

1. Position jamb nuts and secure convertible top switch to instrument panel cluster bezel with two attaching screws.

2. Attach switch connector.

3. Install upper instrument panel cover as described in Note 37b.

70. Seat Warmer On-Off Switch

a. Removal

1. Remove upper instrument panel cover as described in Note 37a.

2. Detach switch connector.

3. Remove two screws securing On-Off switch

to instrument panel cluster bezel and remove switch.

b. Installation

1. Position jamb nuts and secure On-Off switch to instrument panel cluster bezel with two attaching screws.

2. Attach switch connector.

3. Install upper instrument panel cover as described in Note 37b.

71. Map Light Switch

a. Removal

1. Remove two screws securing map light switch to instrument panel cluster bezel.

2. Detach switch connector and remove switch.

b. Installation

1. Connect map light switch connector.

2. Secure map light switch to instrument panel cluster bezel with two screws.

FLEETWOOD ELDORADO

The service information that follows pertains only to the Fleetwood Eldorado. All other service procedures and recommendations for the Fleetwood Eldorado are the same as those for the standard car, as given in the first part of this section.

GENERAL DESCRIPTION

HEADLAMP DOORS

On the 693 style, headlamp doors open whenever the headlamps are lighted and close when the lamps go out.

This system consists of two headlamp doors, two actuators, a headlamp door vacuum storage tank and hoses, Fig. 12-49.

A vacuum valve is integral with the headlight switch.

On cars without Twilight Sentinel, this valve has three hoses connected to it. The yellow-striped center hose, which is routed to the vacuum storage tank provides a constant source of vacuum to the vacuum valve. The red-striped hose furthest from the headlight switch knob carries the vacuum from the storage tank to the bottom side of each actuator and the green-striped hose that is nearest the headlight switch knob is vented to the atmosphere when the headlight switch is off or half-way out.

When headlights are off, atmospheric pressure then pushes pistons inside the actuators toward the low pressure side or the bottom of the actuator, and closes the doors through mechanical linkage.

When the headlight switch is pulled all the way out the green-striped hose nearest the headlight switch knob transmits vacuum to the top side of the actuators and the red-striped hose furthest from the knob is vented to atmospheric pressure. Atmospheric pressure on the bottom side of each actuator then pushes the pistons upward. The linkages then open the headlamp doors.

On 693 cars with Twilight Sentinel a solenoid-operated vacuum valve is mounted on the left rear side of the radiator cradle assembly. This valve contains three ports:

When the left valve to which the green-striped hose is attached is vented to atmospheric pressure, the headlamp doors close.

When the right upper one to which the blue-striped hose is attached is vented to atmospheric pressure, the headlamp doors open.

The right lower valve acts as a port of vacuum supply.

Again, the outer ports work alternately both as vacuum and atmospheric ports to position the piston in the actuator in a manner identical to that described for non-Twilight Sentinel equipped cars.

The vacuum valve is in its normal position when the headlamp doors are closed. When the solenoid is actuated, the valve moves to change the function of the ports and open the doors. When it is de-activated, the valve returns and the function of the ports again changes and the headlamp doors close.

The solenoid utilizes an electrical signal from the light blue wire from the Twilight Sentinel amplifier. Current flows through this wire whenever the headlights are on.

On cars with Twilight Sentinel, two hoses are attached to the vacuum valve and the port nearest the headlight switch knob is plugged. This arrangement permits atmospheric pressure to seep into the system should the solenoid-operated vacuum valve fail, allowing the doors to be opened by hand.

In each system there is a check valve that permits air to flow from ports B and C to port A, Fig. 12-49, whenever the air pressure at ports B and C is greater than the pressure at port A. When the pressure at port A is greater, such as when the ignition is turned off, the valve closes. This arrangement permits a vacuum tight system with the ignition off and the headlamp doors may be operated through one or two cycles on the vacuum stored.

Inside each actuator there is a piston with a rubber seal to provide an air-tight seal.

On cars equipped with vacuum door locks or remote control deck lid, one of two additional vacuum storage tanks is incorporated in the system. On cars with Automatic Climate Control, a second vacuum storage tank is incorporated in the system.

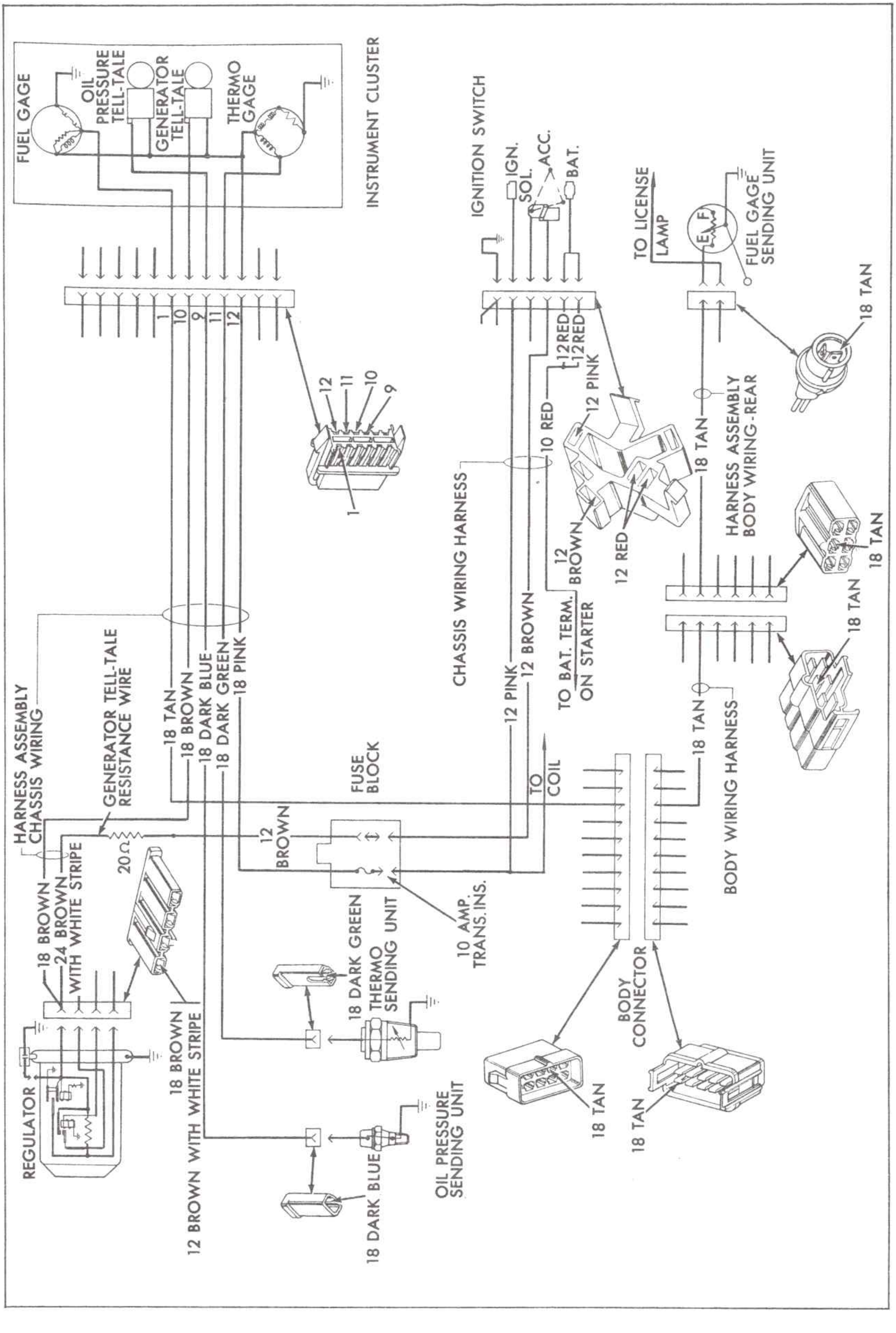


Fig. 12-48 Instruments - 693 Styles

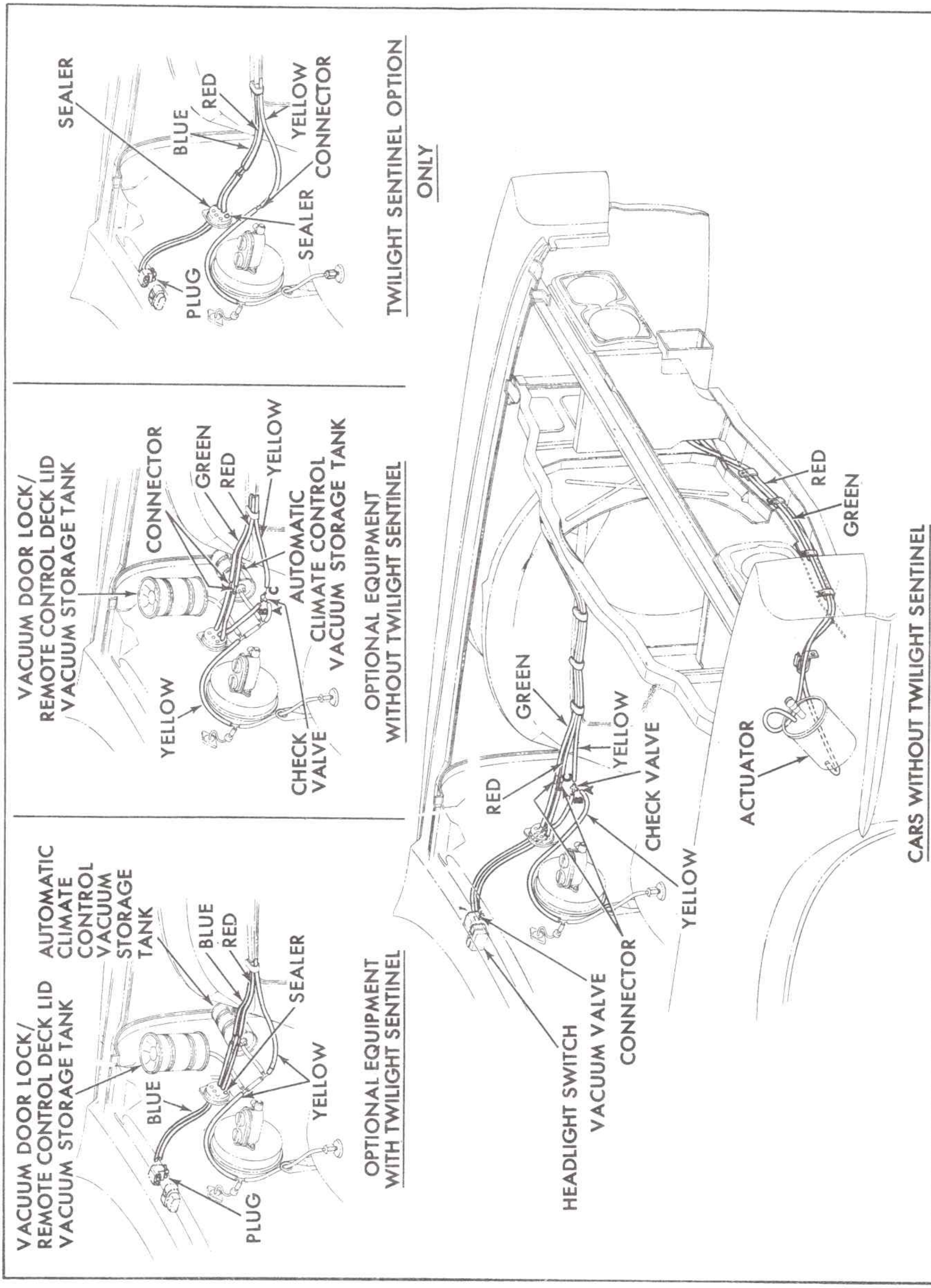


Fig. 12-49 Headlamp Doors - Vacuum Schematic

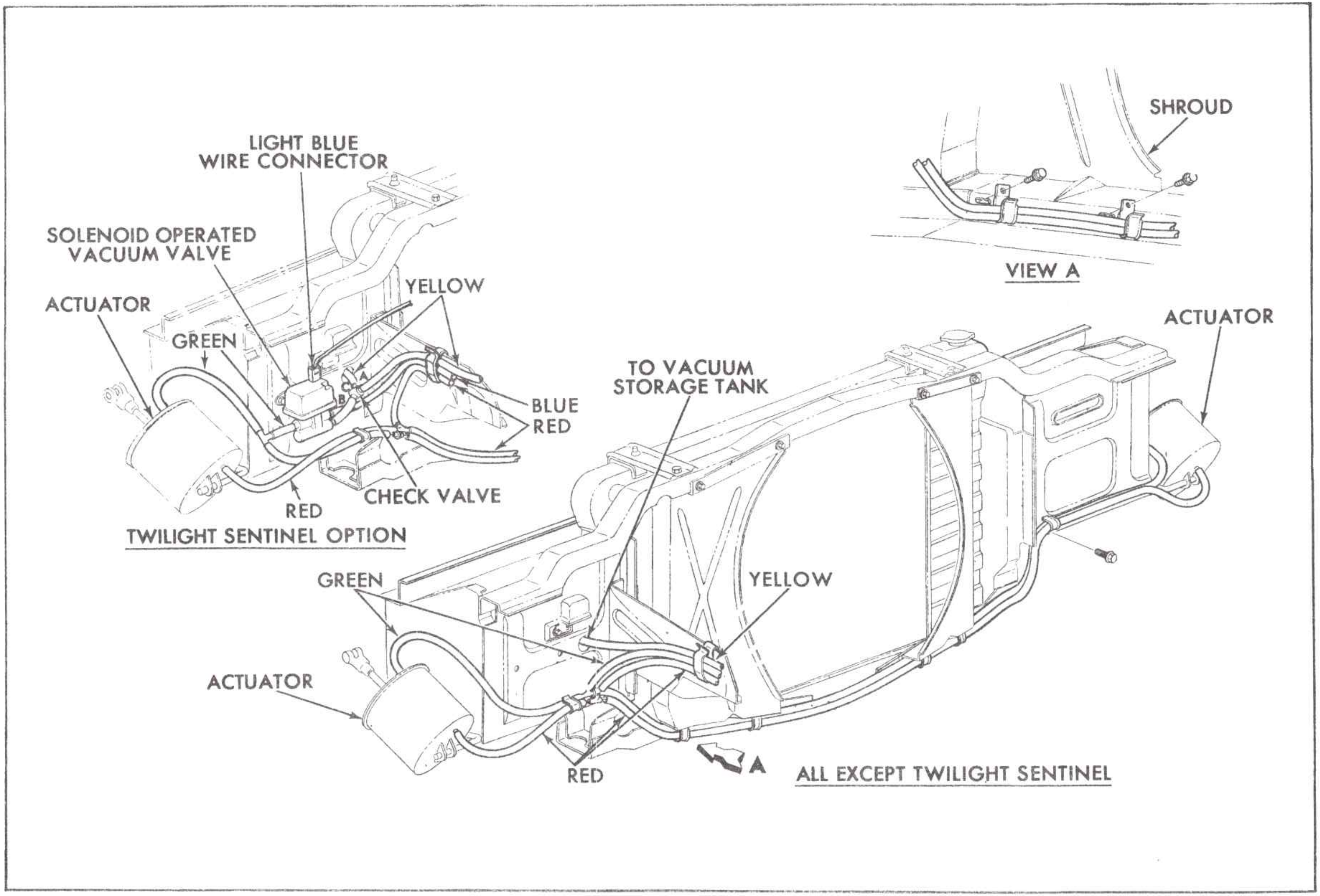


Fig. 12-49 Headlamp Doors - Vacuum Schematic

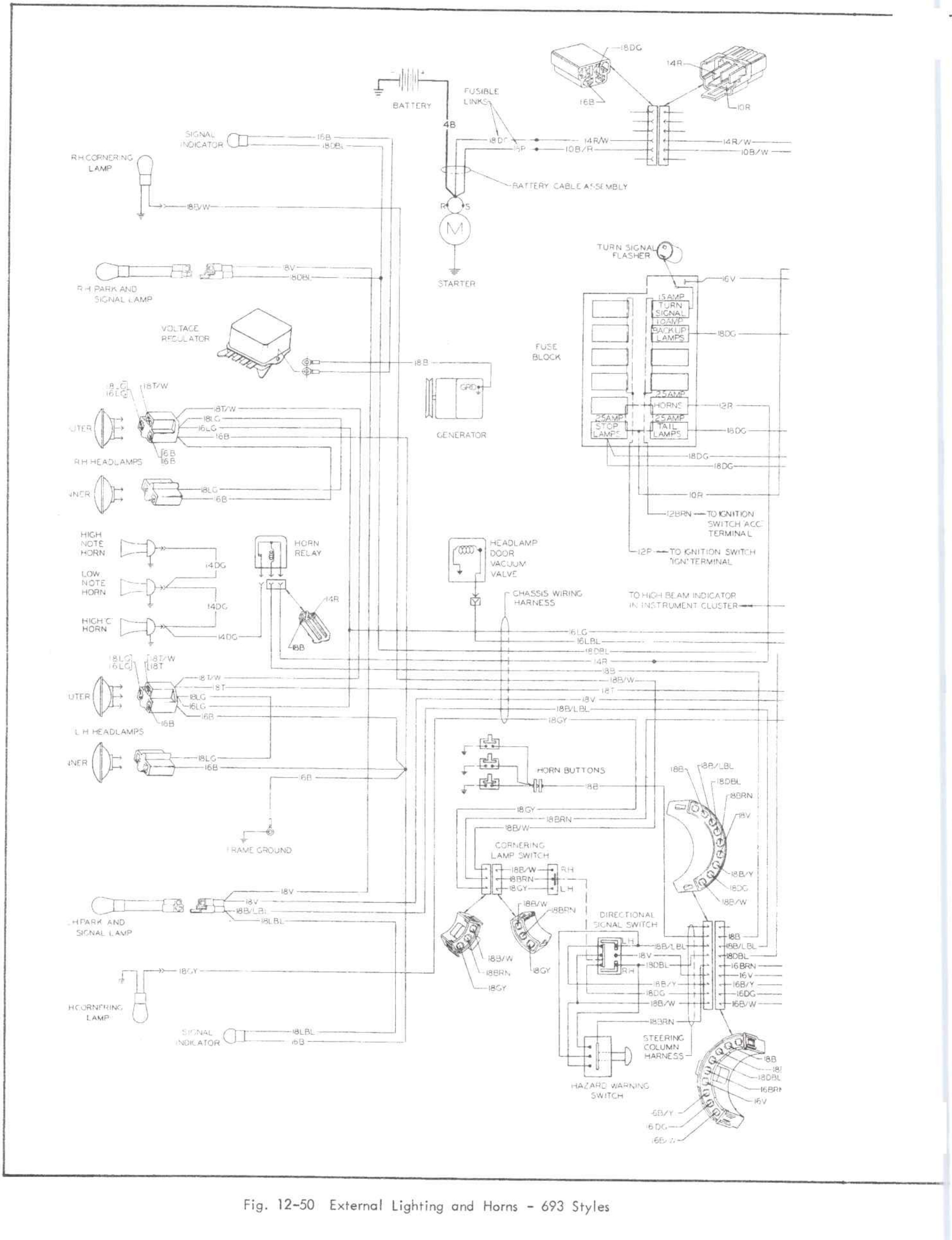


Fig. 12-50 External Lighting and Horns - 693 Styles

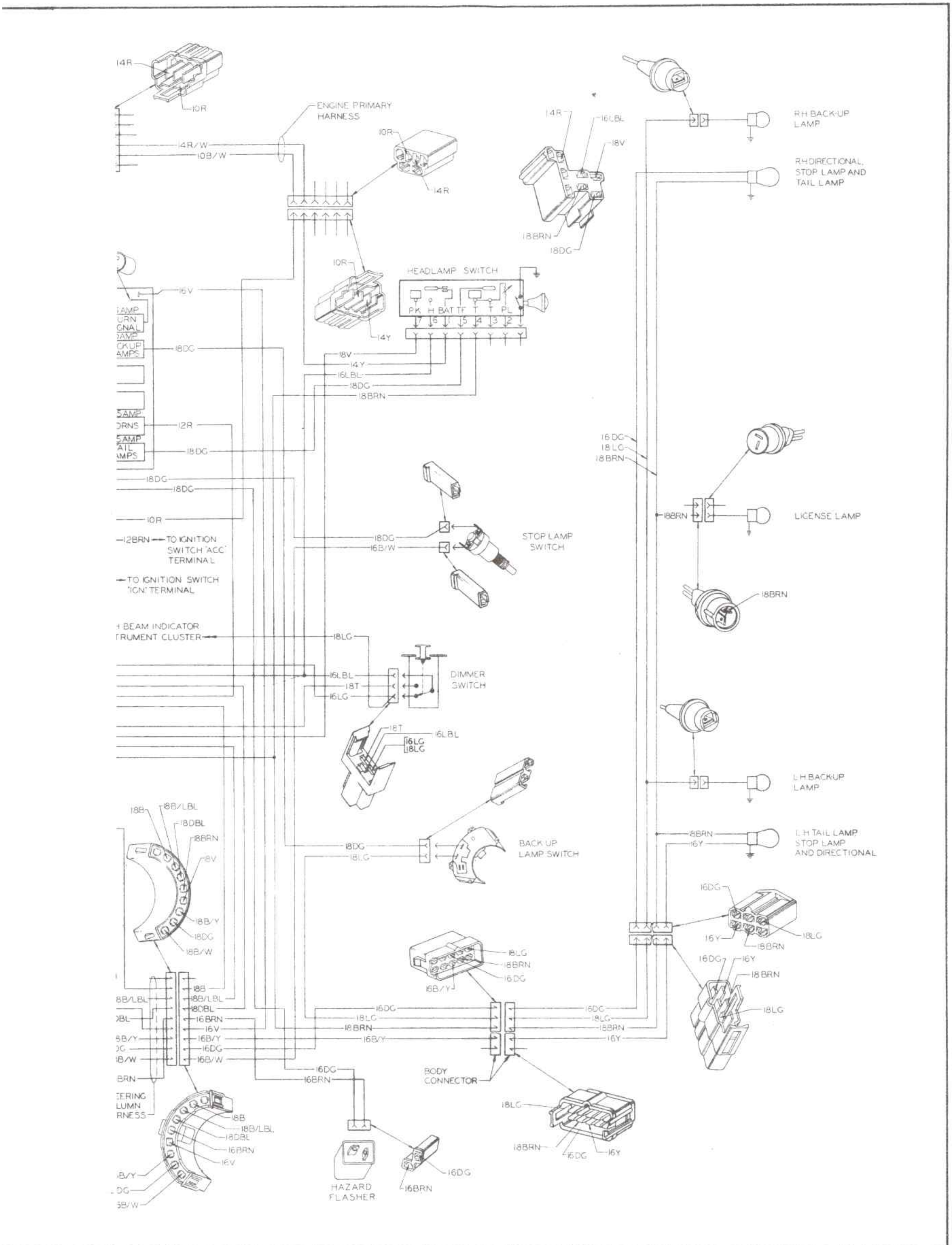


Fig. 12-50 External Lighting and Horns - 693 Styles

72. Headlight Aiming—Screen Method

The factory recommended headlight aiming specifications for the screen method are listed below. However, individual State laws may vary and dealers should check with local authorities.

a. Screen Diagram

Make a headlight aiming screen according to the dimensions and layout shown in Fig. 12-51.

b. Equipment Set-Up

Make sure headlight aiming screen is mounted at a point where there will be an ample level area in front of screen. It is important that floor at aiming screen is at same level as the floor at the point where car is positioned.

c. Headlight Aiming Adjustment

1. Position car so that headlights are exactly 25 feet from aiming screen and car is in line with centerline on screen. To position car, sight through rear window, lining up centerline of rear window reveal molding escutcheon with inside rear view mirror bracket and car centerline on screen.

2. Position two 36 inch sticks vertically at the left front and left rear wheels. Sight over sticks and move left side of screen up or down, as required, to line up horizontal headlight centerline on screen with the 36 inch sight line. Follow same procedure on right side.

3. Mark wall adjacent to horizontal centerline of headlight line on aiming screen. Place a mark on wall 9-5/8" below the 36 inch mark.

Move screen down until horizontal centerline of headlight is even with this point.

4. Set headlights on high beam. Make sure all four headlights are on.

5. Cover both left side headlights and right side outer light and adjust right inner light as required until hot spot centers at point "B" on screen, Fig. 12-51.

6. Cover both right side headlights and left side outer light and adjust left inner light as required until hot spot centers at point "C" on screen, Fig. 12-51.

7. Set headlight on low beam. Only outer headlights should light.

8. Cover left outer headlight and adjust right outer light as required until top of hot spot "D" is on horizontal centerline of headlight and left edge of hot spot is on vertical centerline of outer light, Fig. 12-51.

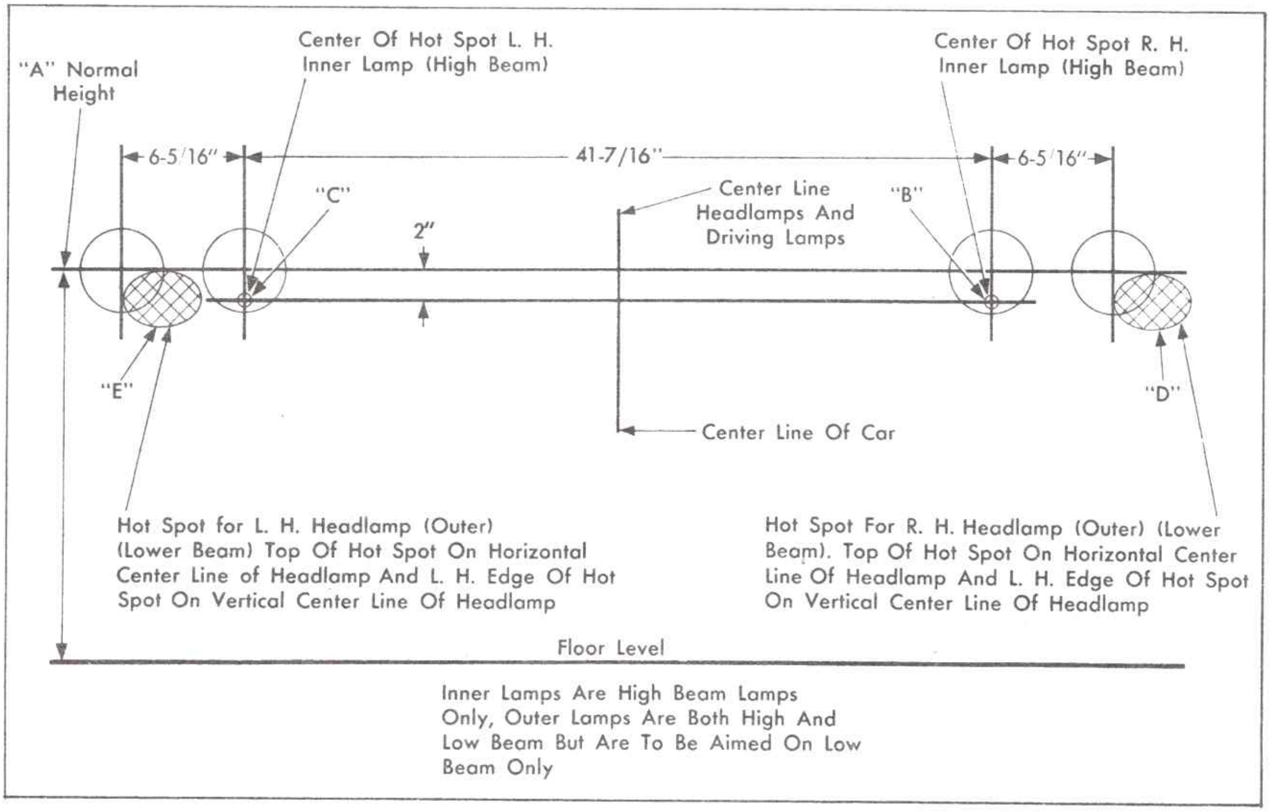


Fig. 12-51 Headlight Aiming Screen

9. Cover right outer headlight and adjust left outer light as required until top of hot spot "E" is on horizontal centerline of headlight and left edge of hot spot is on vertical centerline of outer light, Fig. 12-51.

73. Sealed Beam Unit Replacement

1. Pull headlight switch fully out to open headlamp doors and disconnect negative battery cable.

2. Remove four screws that hold headlight bezel to headlight housing and remove bezel.

3. Disconnect retaining spring from retaining ring and slide sealed beam assembly off adjusting screws.

4. Disconnect three-way electrical connector from sealed beam unit.

5. Remove three screws that hold retaining ring to mounting ring and separate mounting ring from sealed beam unit.

6. Remove retaining ring from sealed beam unit.

7. Install new sealed beam unit in retaining ring.

8. Install ring with sealed beam unit on mounting ring and secure with three attaching screws.

9. Connect three-way connector to sealed beam unit.

10. Install sealed beam assembly on adjusting screws and connect retaining spring to retaining ring.

11. Install headlight bezel on housing and secure with four attaching screws.

12. Connect negative battery cable and push headlight switch in.

13. Aim headlights as described in Note 1 or 72.

74. Bulb Replacement

A complete list of replacement bulbs for 1967 Cadillac cars is given in the bulb chart, page 12-78. The procedures for making replacements that are described in this note are exclusive to the Fleetwood Eldorado. In those cases where the procedures for all cars are identical, refer to Note 4.

CAUTION: Disconnect negative battery cable at battery when replacing bulbs.

a. Turn Signal Indicator Lamp Bulbs

1. Open hood and working through hood opening remove snap-in socket and bulb.

2. Replace bulb.

3. Reinstall socket and bulb.

b. Front Turn Signal and Parking Lamp Bulb

1. Remove two Phillips head screws securing lens to lamp and remove lens.

2. Replace bulb.

3. Install lens on housing and secure with two Phillips head screws.

c. Rear Tail, Stop, and Signal Lamp Bulb

1. Open trunk lid and unfasten trunk liner screw.

2. Remove bulb and socket.

3. Replace bulb.

4. Install bulb into socket hole so that locating tank on socket engages notch on socket hole.

d. Back-Up Lamp Bulb

1. Remove two Phillips head screws securing lens to housing and remove lens.

2. Replace bulb.

3. Secure lens to housing with two Phillips head screws.

e. License Lamp Bulb

1. Remove two Phillips head screws securing lens to housing and remove lens.

2. Replace bulb.

3. Install lens on housing and secure with two Phillips head screws.

f. Cornering Lamp Bulb

a. Removal

1. Disconnect orange cornering lamp wire connector from under hood.

2. Working inside wheel housing, remove screw, starwasher, washer securing rubber mat and cornering lamp to fender.

NOTE: Count any shims present at cornering lamp for assembly.

3. Remove screw and washer securing top rear of cornering lamp to fender.

4. Remove screw and washer at front of cornering lamp and remove cornering lamp assembly.

b. Disassembly

1. Remove four Phillips head screws that secure bezel to housing and remove bezel and lens.

2. Remove bulb.

c. Assembly

1. Install bulb in housing.

2. Install lens and bezel on housing and secure with four Phillips head screws.

d. Installation

1. Position cornering lamp assembly on fender and loosely install screw and washer securing front of cornering lamp assembly to fender.

2. Loosely install screw and washer securing top rear of cornering lamp to fender.

3. Position any shims found during removal and tighten the two previously installed screws.

4. Install screw, starwasher and washer to rubber mat and front fender.

5. Attach orange wire connector from under hood.

75. Turn Signal Indicator Lamp Assembly

a. Removal

1. Open hood and working through hood opening remove socket and bulb.

2. Remove two nuts with attached starwashers securing housing assembly to fender and trim plate.

b. Installation

1. Working through hood opening, position housing assembly so that two studs from trim plate engage holes in housing and secure with two nuts with attached starwashers.

2. Install socket and bulb.

76. Front Turn Signal and Parking Lamp Assembly

a. Removal

1. Disconnect negative battery cable at battery.

2. Pull wiring connector retainer clip free and disconnect wiring connector.

3. Remove two nuts that secure assembly to bumper and pull assembly out.

b. Installation

1. Position lamp assembly in bumper. Secure with two attaching nuts.

2. Connect wiring connector and attach wiring retainer in position.

3. Connect negative battery cable at battery.

77. Rear Tail, Stop and Signal Assembly

a. Removal

1. Open trunk lid.

2. Remove bulb.

3. Remove three nuts with attached washers and remove assembly from fender.

b. Disassembly

1. Remove two nuts with attached starwashers securing housing to extension and separate extension from housing.

2. Remove two Phillips head screws securing end cap to extension. Separate end cap from extension.

3. Remove two Phillips head screws securing lens ornament to housing and remove lens ornament and lens.

4. If necessary, remove weatherstrip by removing seven Phillips head screws securing weatherstrip and retainer to extension.

c. Assembly

1. If removed, position weatherstrip and retainer on extension and secure with seven Phillips head screws.

2. Position lens and lens ornament on housing and secure with two Phillips head screws.

3. Position end cap on extension and secure with two Phillips head screws.

4. Position extension on housing and secure with two nuts with attached starwashers.

d. Assembly

1. Position assembly in fender and secure with three nuts with attached washers.

2. Install bulb into socket hole so that locating tang on socket engages notch on socket hole.

78. Back-Up Lamp Assembly

a. Removal

1. Disconnect back-up bulb connector.

2. Remove two screws and washers securing back-up lamp assembly to rear bumper center bar and remove back-up lamp from housing.

b. Installation

1. Position back-up lamp on rear bumper center bar and secure with two screws and washers.

2. Connect back-up bulb connector.

79. Trunk Lamp Housing

a. Removal

1. Open trunk lid.

2. Remove trunk bulb.

3. Disconnect retainer clip from trunk lid.

4. Remove one Phillips head screw securing trunk lamp housing to trunk lid.

5. Remove housing.

6. Disconnect trunk lamp housing black lead wire connector from orange wire connector.

b. Installation

1. Connect black and orange wire connectors.

2. Install housing and secure to trunk lid with one Phillips head screw.

3. Position connector and wiring inside trunk lid and secure orange wire to trunk lid with retainer clip.

80. Checking Headlamp Doors (Fig. 12-49)

a. Quick Check

1. Run engine to insure a vacuum build-up.

2. Make certain Twilight Sentinel time delay and master On-Off control lever is off on cars so equipped.

3. With headlight switch off, headlamp doors should close and with switch fully out, headlamp doors should open and headlights should light.

4. On cars with Twilight Sentinel, turn headlight switch off. Turn Twilight Sentinel time delay and master On-Off control lever anywhere clockwise of OFF position. Cover photocell opening in radio center speaker grille (left speaker grille on Stereo radio cars) with a black cloth. Headlamp doors should open and headlights turn on within 60 seconds. Remove black cloth and headlamp doors should close and headlights turn off within 60 seconds.

5. Turn off ignition and operate doors through one cycle.

NOTE: If any corrections to the system are made while performing the following procedures, repeat the quick check described above.

b. Analyzing Quick Check

1. If one headlamp door operated properly while the other failed to operate during the above check, proceed to part (i) of this note.

2. On cars equipped with Twilight Sentinel, if headlights failed to operate properly when headlight switch was used or Twilight Sentinel was used, the electrical malfunction must be located and corrected. See Section 15, Note 37.

3. On cars equipped with Twilight Sentinel, if headlights operate properly, but both headlamp doors do not operate properly, see part (c) of this note to check operation of vacuum valve solenoid and for an open light blue wire to the splice near the dimmer switch.

4. If headlamp doors failed completely to operate during the quick check and steps 2 and 3 outlined above were performed, check vacuum circuitry as outlined in part (d) of this note.

5. If headlamp doors fail to operate through one cycle with ignition switch off, but operate properly when performing all other parts of quick check, refer to part (j) of this note.

c. Checking Solenoid for Electrical Problem (Twilight Sentinel Cars Only)

1. Have helper pull headlamp switch fully out and listen for a clicking sound at the solenoid. If solenoid clicks the solenoid portion of the solenoid operated vacuum valve is all right. If it does not click, proceed to step 2.

2. Disconnect the light blue wire terminal connector from the vacuum valve solenoid.

3. Connect one end of a jumper wire to the positive battery terminal and the other end to the terminal on the vacuum valve solenoid. Solenoid should click. If it does not, the vacuum valve solenoid should be replaced.

4. If solenoid does click and both Twilight Sentinel and headlight switch circuits operate properly, check for an open light blue wire from the solenoid operated vacuum valve to the splice near the dimmer switch.

d. Vacuum Circuitry Check

1. Run engine at idle and check for secure hose connections at all points in system and for any leaks in vacuum system.

2. Make certain headlight switch is off.

3. Working at each actuator, first remove the bottom red-striped hose and feel for a vacuum condition, which should be felt. Quickly replace hose to prevent loss of vacuum. Then remove green-striped hose at top of actuator and a vacuum condition should not be felt. Attach hose.

4. Pull headlight switch all the way out.

5. Working at each actuator, first remove the top green-striped hose and a vacuum condition should be felt. Quickly replace hose to prevent loss of vacuum. Then remove red-striped hose at bottom of each actuator. A vacuum condition should not be felt. Attach hose.

e. Analyzing Vacuum Circuitry Check

1. If system operated as described above, refer to part (i) of this note.

2. If one actuator operated properly and other failed to operate, check for defective hoses to the affected actuator. If hoses are all right, refer to part (i) of this note.

3. If system failed to operate properly at both actuators, refer to part (f) of this note on cars without Twilight Sentinel or part (g) on cars with Twilight Sentinel.

f. Vacuum Valve Check (Cars Without Twilight Sentinel)

1. Disconnect three vacuum hoses at first connections in front of cowl.

2. With headlight switch fully in, blow on center yellow-striped hose. Air should be felt at inboard red-striped hose and not felt at green-striped outboard hose. Seal red-striped hose with finger to check for leaks.

3. Pull headlight switch fully out and blow on center yellow-striped hose. Air should be felt at outboard green-striped hose and none should be felt at inboard hose. Seal green-striped hose with finger to check for leaks.

4. If system does not perform as described above, remove headlight control switch assembly as described in Note 44a, inspecting for a loose hose connection while removing assembly.

5. To check for a defective headlight switch vacuum valve, apply air to center port and air should come out port furthest from headlight switch knob with knob fully in. With knob fully out air should come out port nearest headlight switch knob. If headlight switch vacuum valve is defective, headlight switch must be replaced.

6. Make normal installations and hose connections after completion of test.

g. Headlamp Door Vacuum Valve (Twilight Sentinel Cars)

1. With headlight switch off, disconnect the lower port yellow-striped hose of vacuum valve at check valve and disconnect green-striped and blue-striped hoses at vacuum valve.

2. Blow air through the lower yellow-striped port hose. Air should be felt at outboard port, and none at inboard upper port. Seal the outboard port with finger to check for leaks.

3. Remove light blue wire connector at solenoid vacuum valve and apply a 12-volt power source to the terminal at the relay.

4. Blow air through the lower yellow-striped port hose. Air should be felt at the inboard upper port and none at outboard port. Seal the inboard upper port to check for leaks. If vacuum valve does not perform as described in steps 3 and 4, the assembly should be replaced.

5. Check air filter (integral with solenoid) and clean if required.

6. Make normal hose and wiring connections after completion of test. If check fails to isolate problem, proceed to part (h) of this note.

h. Vacuum Valve Check (Twilight Sentinel Cars)

1. Disconnect two vacuum hoses at first connections in front of cowl.

2. With headlight switch fully in, blow on blue-striped hose and air should be felt at red-striped hose. Seal red-striped hose to check for leaks.

3. Pull headlight switch fully out and blow on blue-striped hose. System should be air-tight.

4. If system does not perform as described above, remove headlight switch as described in Note 44a, inspecting for a loose hose connection while removing assembly.

5. To check for a defective headlight switch vacuum valve, apply air pressure to center port and air should come out port furthest from headlight switch knob with knob fully in. With knob fully out, valve should be airtight. If headlight switch vacuum valve is defective, headlight switch must be replaced.

6. Make normal installations and hose connections after completion of test.

i. Checking Headlamp Door Linkage and Actuator

1. Disconnect hoses at actuator of affected headlamp door or doors and check for a binding condition by manually operating linkage. Repair as necessary.

2. If problem is not in linkage and vacuum circuitry has already been checked, proceed to step 3.

3. Remove actuator as described in Section 11, Note 12a.

4. Position actuator on workbench so that rod with attached clevis is up and pull rod fully up. Seal air port on rod side of actuator with finger and push down on clevis. Piston should remain in one position despite pressure on clevis. If rod can be pushed down, actuator should be replaced. Remove finger and check for free full travel of rod. If rod will not travel freely, actuator should be replaced.

5. Install actuator as described in Section 11, Note 12b.

j. Checking Leak Down Condition

If a leak down condition occurs, the vacuum system, check valve or either actuator could be leaking. To check proceed as follows:

1. Run engine at idle and check for secure hose connections at all points in system and check for any leaks in vacuum system.

2. Remove check valve.

3. Seal port B, Fig. 12-49, and blow through port C. Air should be felt at port A. Then blow through port A with port B sealed. No air pressure should be felt at port C. If check valve does not operate as described above, it must be replaced.

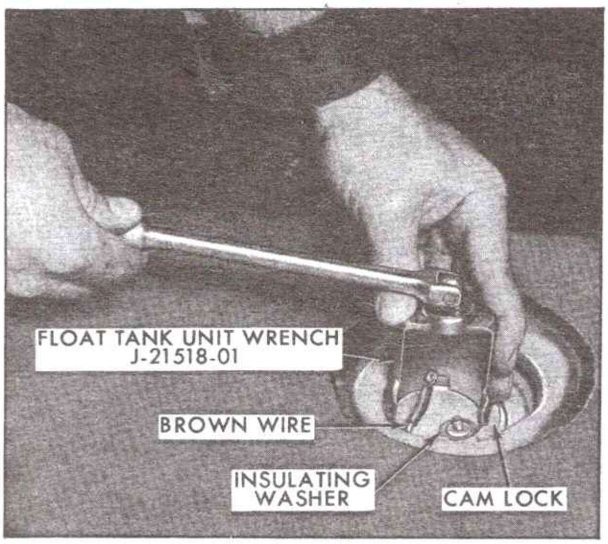


Fig. 12-52 Removing Float Tank Unit

4. Install check valve, Fig. 12-49, making certain port A leads to vacuum source.

5. Remove actuator as described in Section 11, Note 12a.

6. Position actuator on workbench so that rod with attached clevis is up and pull rod fully up. Seal air port on rod side of actuator and push down on clevis. Piston should remain in one position despite pressure on clevis. If rod can be pushed down, actuator should be replaced. Remove finger and check for free full travel of rod. If rod will not travel freely, actuator should be replaced.

7. Install actuator as described in Section 11, Note 12b.

81. Fuel Tank Float Unit

a. Removal

1. Drain tank of gasoline.

2. Open deck lid and remove rear carpet trim to gain access to float tank unit.

3. Cut out mat over tank float unit.

4. Clean excess sealer from edges of cover plate and pry cover plate up to remove.

5. Remove nut, starwasher, brown wire and insulating washer from tank unit.

6. Using Float Tank Unit Wrench, J-21518-01, remove cam lock as shown in Fig. 12-52.

7. Remove tank float unit from tank, being careful not to damage ground wire.

8. Cover fuel tank unit opening and working away from tank, unsolder black float tank unit ground wire.

b. Installation

1. Solder black ground wire to float tank unit, working away from tank.

2. Uncover fuel tank unit opening and install tank float unit in tank.

3. Using Float Tank Unit Wrench, J-21518-01 install cam lock as shown in Fig. 12-52. Be sure cam is rotated completely and is in retaining detents.

4. Install insulating washer, brown wire, star-washer and secure with nut.

5. Place sealer on cover plate and position on fuel tank float unit.

6. Install portion of mat cut out during disassembly.

7. Install rear carpet trim and close deck lid.

82. Shroud Top Ventilator Frame and Grille

a. Removal

1. Remove right and left windshield wiper arm and blade assemblies as described in Note 33, steps 1 and 2.

2. Raise hood and remove nine screws retaining front and side edges of ventilator frame to cowl, noting locations of any shims for installation purposes.

NOTE: Access to end screws is gained by opening door, and removing front body hinge cover plates

3. Carefully raise front edge of ventilator frame slightly and disengage washer hoses.

4. Raise rear edge of frame and slide forward to disengage frame from molding. Slide frame over windshield wiper transmission shafts and remove shroud top ventilator frame and grille.

b. Installation

1. Apply medium-bodied sealer around ventilator frame screw attaching holes.

2. Position shroud top ventilator frame and grille and, with front edge raised slightly, engage washer hoses to washer nozzle adapter.

3. Carefully slide frame rearward to engage rear edge of frame between windshield lower reveal moldings and molding attaching clips.

4. Install nine screws that secure front and side edges of frame to cowl.

5. Install wiper arm and blade assemblies as described in Note 33, step 3.

IMPORTANT: When installing wiper arm and blade assemblies, be sure to "overpark" the arm and blade assemblies below the windshield so that a proper return to park position always results. Make certain left blade assembly is above right blade assembly in park position.

83. Windshield Wiper Transmission

a. Removal

1. Remove shroud top ventilator frame and grille assembly as described in Note 82a.

2. Remove two screws and access hole cover from opening in center of cowl to gain access to wiper unit crank arm.

3. Remove locknut securing wiper unit crank arm to ball socket stud.

4. Remove three transmission mounting screws on right and left transmissions.

5. Disengage ball socket stud at wiper unit and remove transmissions and linkages as a complete assembly.

b. Inspection and Overhaul

1. Inspect each ball socket for binding, damage or excessive looseness.

2. If either wiper transmission needs to be replaced, use a #10 drill to remove the two rivets holding the defective component to its mating link ball joint.

3. Lubricate link ball carefully.

4. Assemble ball socket bearings around the link ball.

5. Secure socket bearing and link arm with two attaching bolts from parts package. Thin socket bearing should be next to link arm. Install bolts so that screw enters from link arm side.

c. Installation

1. Position transmissions and linkages in shroud top opening with ball socket stud engaging crank arm.

NOTE: When properly positioned, the hole in crank arm will mate with ball socket stud.

2. Install three transmission mounting screws at each transmission, making certain that driver side transmission arm points down and passenger side transmission arm points up.

3. Install locknut securing wiper unit crank arm to ball socket stud, making certain stud is fully seated.

4. Secure access hole cover to cowl with two screws.

5. Install shroud top ventilator frame and grille assembly as described in Note 82b.

84. Ventilation Control Panel Cable and Knob Assembly (Right or Left—693 Styles Only)

a. Removal

1. Remove two screws that secure knob to underside of lower instrument panel, Fig. 12-38.

2. Remove clip washer that holds bowden cable on control lever pins.

3. Remove bowden cable clamp screw and disconnect cable from control lever pin and cable clamp.

b. Installation

1. Install bowden cables on control lever pin and secure with clip washer.

2. Install bowden cable in cable clamp and tighten screw that holds cable clamp.

3. Install two screws that secure knob to underside of lower instrument panel, Fig. 12-38.

BULB DATA CHART

Function	Bulb No.	C/P	Body Style
Ash Tray - Front	1445	.7	All
Back Up (In Tail Lamp)	1195	50	All Except 69347
Back Up	1156	32	69347
Console Lamp	57	2	68347-49-67-69347 (When Ord.)
Cornering Lamp	1195	50	All
Courtesy Lamp - Rear Quarter	90	6	68069-68169-68247-49-68349-68369-69347
Courtesy Lamp - Console	212/212-1	6	68347-49-67-69347
Courtesy Lamp - Instrument Panel	89	6	All
Courtesy Lamp - Rear Door	212/212-1	6	68069-68169-69723-69733
Courtesy Lamp - Rear Quarter Armrest	212/212-1	6	68367
Cruise Control Dial	1445	.7	All (When Ord.)
Cruise Control (Lock In Indicator)	161	1	All (When Ord.)
Generator Tell-Tale	161	1	All
Glove Compartment	1895	2	All
Headlamp Lower or Inner	L4001	37.5 Watts	All
Headlamp Upper or Outer	L4002	37.5 Watts 55.0 Watts	All
Headlamp Switch	1816	3	All
Heater or A/C Control	1816	3	All
High Beam Indicator	161	1	All
Ignition Lock	1445	.7	All
License Lamp	67	4	All
Low Brake Tell-Tale	161	1	All
Low Oil Tell-Tale	161	1	All
Map Lamp	89	6	All
Panel Lamps	168	3	All
Park-Signal Lamp	1157A	32/4	All Except 693
	1157NA	32/4	693
Radio Dial Lamp	1816	3	All (When Ord.)
*Radio AM-FM Band Indicators	250	.5	All (When Ord.)
*Radio AM-FM Band and Stereo Indicators	2181D	.4	All Except 69723-69733-69890 (When Ord.)
*Radio - Rear Control Indicator	250	1	69723-69733 (When Ord.)
Rear Seat Warmer Indicator	1895	2	69723-69733 (When Ord.)
Spot Lamp	90	6	69733
Spot-Reading	1004	15	69723-69733-68169
Stop, Tail & Signal	1157	32/4	All
Tray, Seat Back	212/212-1	6	68169
Trunk Compartment	89	6	All Exc. 69890 (When Ord.)
Trunk Lid Tell-Tale	161	1	All Exc. 69890 (When Ord.)
Turn Signal Indicator	1445	1	All Except 693
	1895	2	693
Warning Lamp-Front Door	212/212-1	6	68347-49-67-69-69347 68069-68169
Warning Lamp-Rear Door	212/212-1	6	68169-68069-68347-68369
Windshield Wiper Switch	1895	2	All

*Serviceable only by Radio Technician

FUSE AND CIRCUIT BREAKER CHART

UNIT	FUSE RATING
Accessories (Fuse Panel)	25 Amp.
Antenna Rear Window De-Fogger Window Control Relay	
Air Conditioner and Heater (Fuse Panel)	25 Amp.
Heater Only (Fuse Panel)	15 Amp.
Back-Up (Fuse Panel)	10 Amp.
Blower Motor Fuse - (In-line on top of right rocker arm cover on all except 693) (In-line behind generator on 693)	30 Amp.
Body Feed (Fuse Panel)	25 Amp.
*Chauffer Light Cigar Lighter(s) Clock Courtesy Lights Glove Box Light Interior Body Lamps Map Light Trunk Tell-Tale	
Guide-Matic (In-Line Above L.H. Kickpad)	4 Amp.
Headlights and Parking Lights (Headlight Switch)	15 Amp. (CB)
Horn (Fuse Panel)	25 Amp.
On cars equipped with power windows and/or power seats, and on convertible styles, the 25 Amp. horn fuse is replaced by a 40 Amp. Circuit Breaker	or 40 Amp. (CB)
Instruments and Transmission (Fuse Panel)	10 Amp.
Downshift & Stator Control Solenoids Tell-Tale Lights and Gages except Trunk Cruise Control Automatic Indicator	
Panel Lights (Fuse Panel)	4 Amp.
Radio (Fuse Panel)	7-1/2 Amp.
Seat Warmer (Right Dust Shield)	25 Amp. (CB)
Seat Warmer (In-line at Voltage Regulator)	6 Amp.
Stop and Hazard Warning Flasher (Fuse Panel)	25 Amp.
Tail (Fuse Panel)	25 Amp.
Ash Tray Light Cornering Lights Ignition Switch Light Tail Lights Twilight Sentinel	
Turn Signal (Fuse Panel)	15 Amp.
Windshield Wipers (Fuse Panel)	25 Amp.

*Fleetwood Seventy-Five Sedans and Limousines

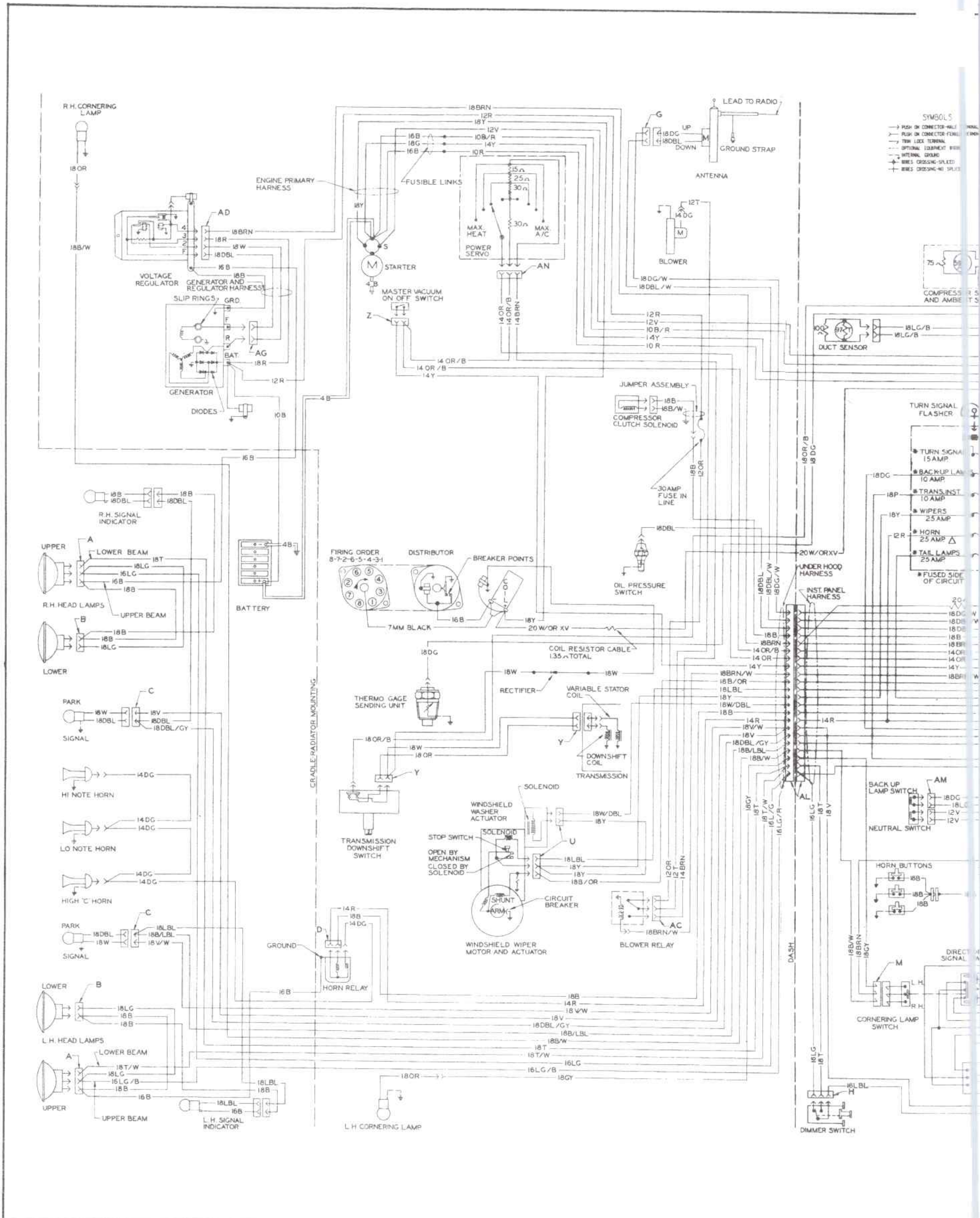


Fig. 12-53 Chassis Circuit Diagram (Except 693 and 697 Styles)

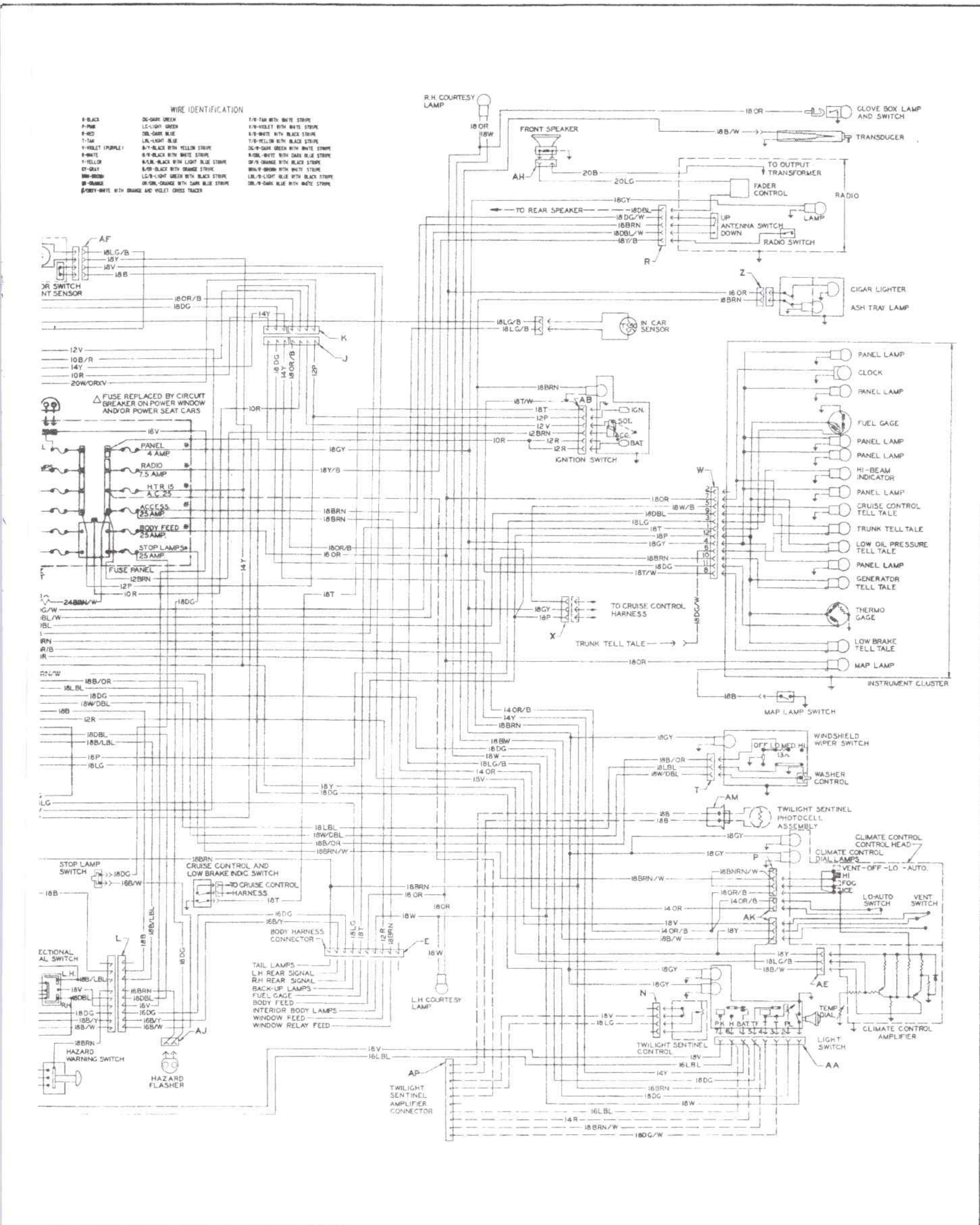


Fig. 12-53 Chassis Circuit Diagram (Except 693 and 697 Styles)

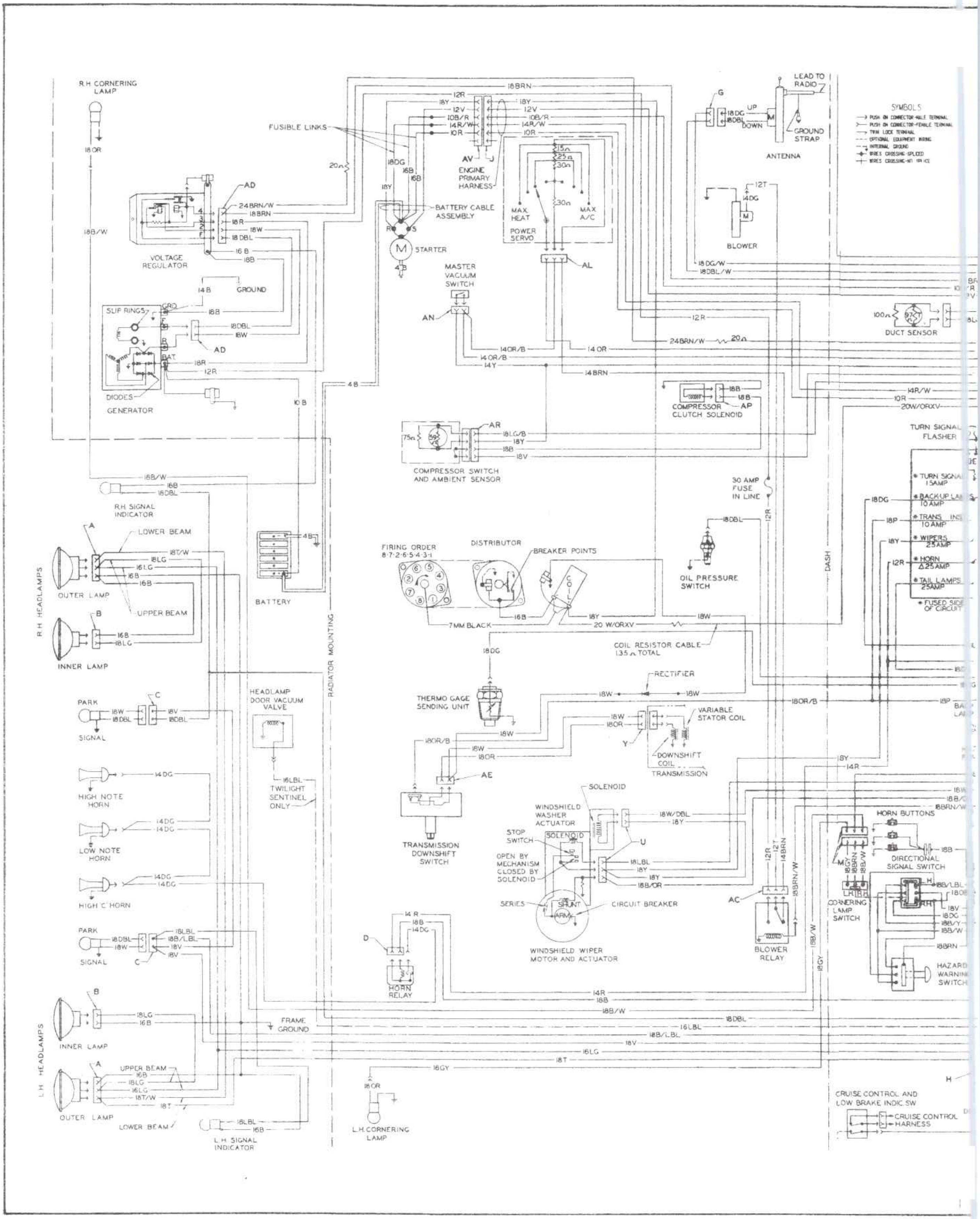


Fig. 12-54 Chassis Circuit Diagram (693 Style)

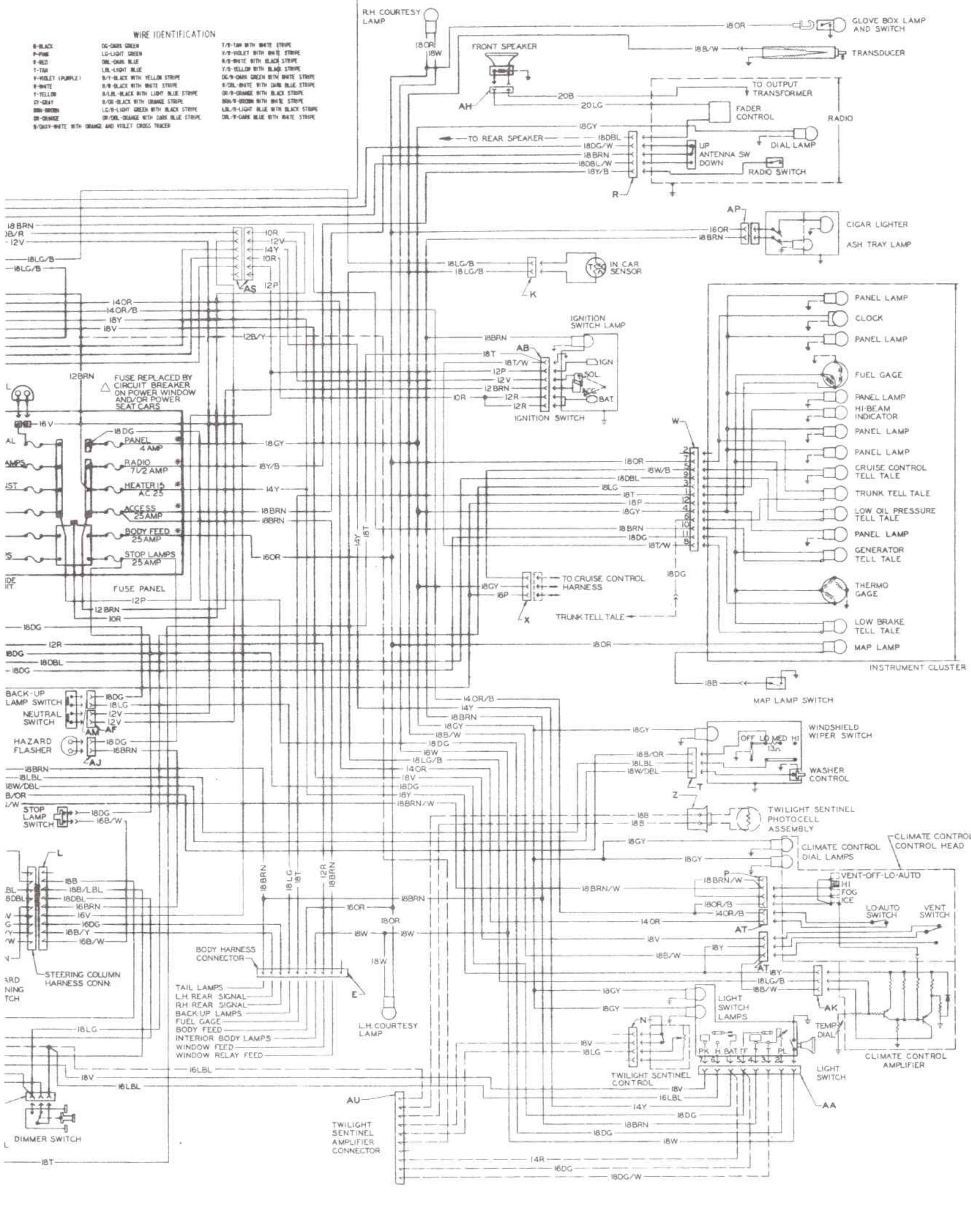


Fig. 12-54 Chassis Circuit Diagram (693 Style)

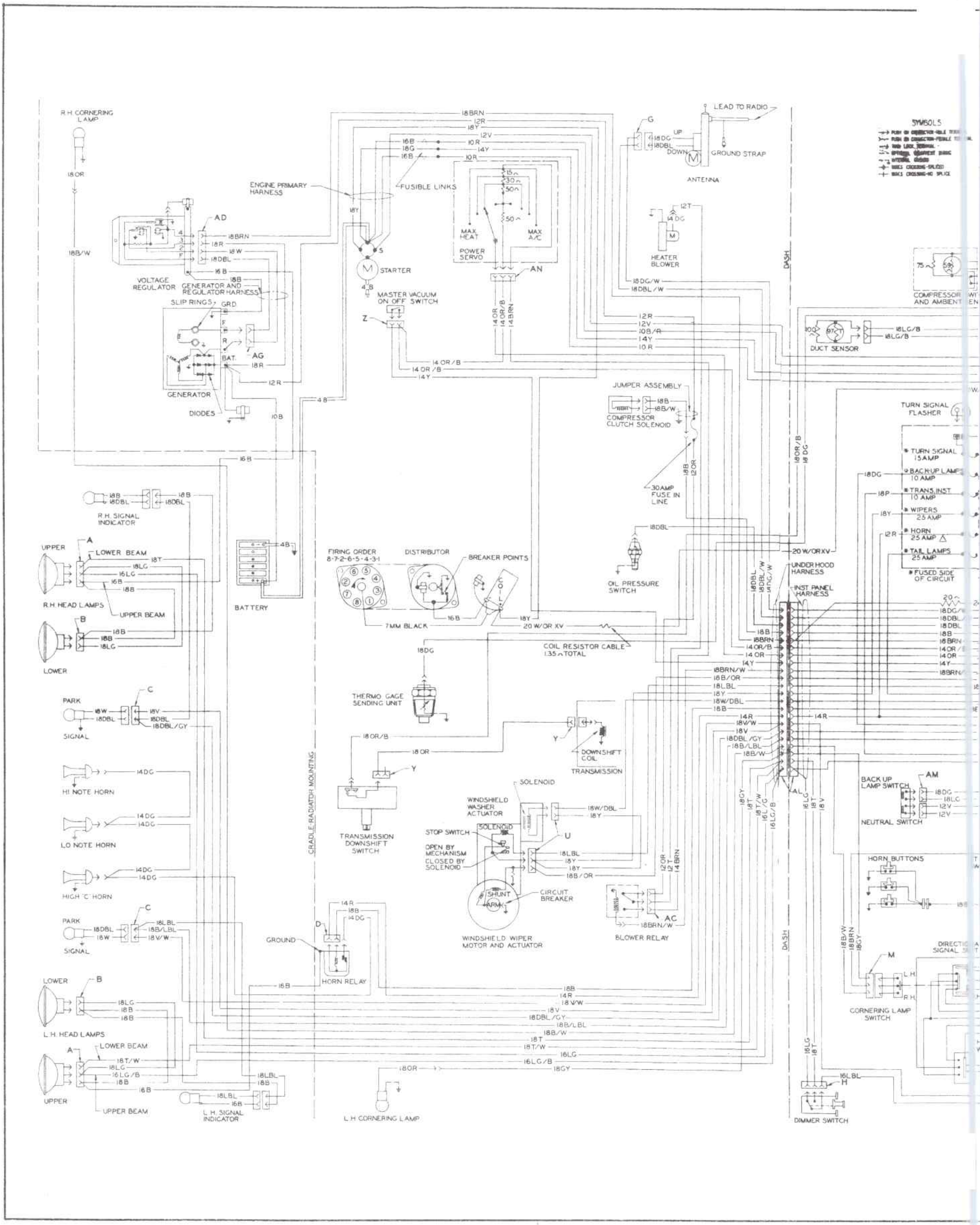


Fig. 12-55 Chassis Circuit Diagram (697 Styles)

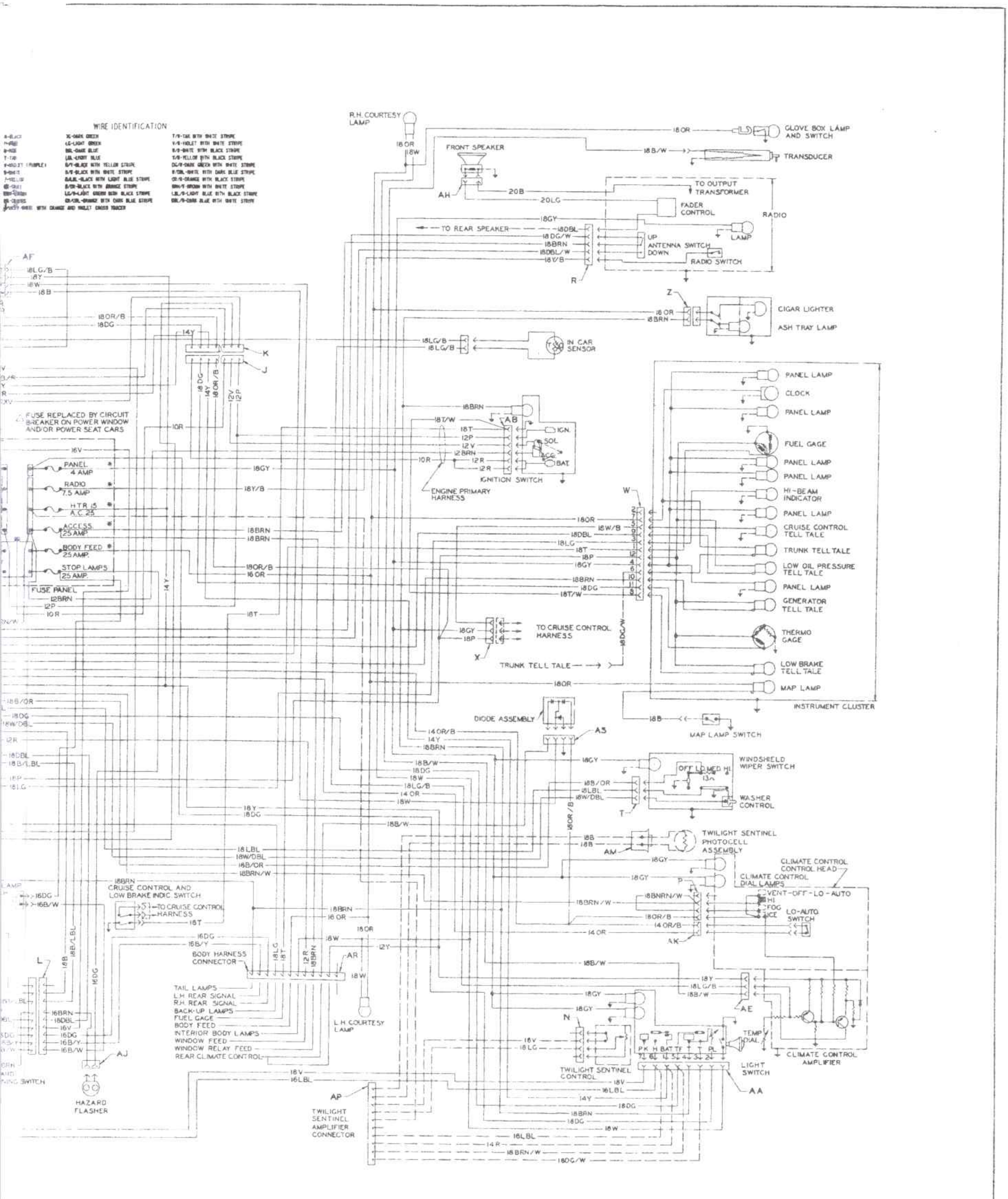


Fig. 12-55 Chassis Circuit Diagram (697 Styles)

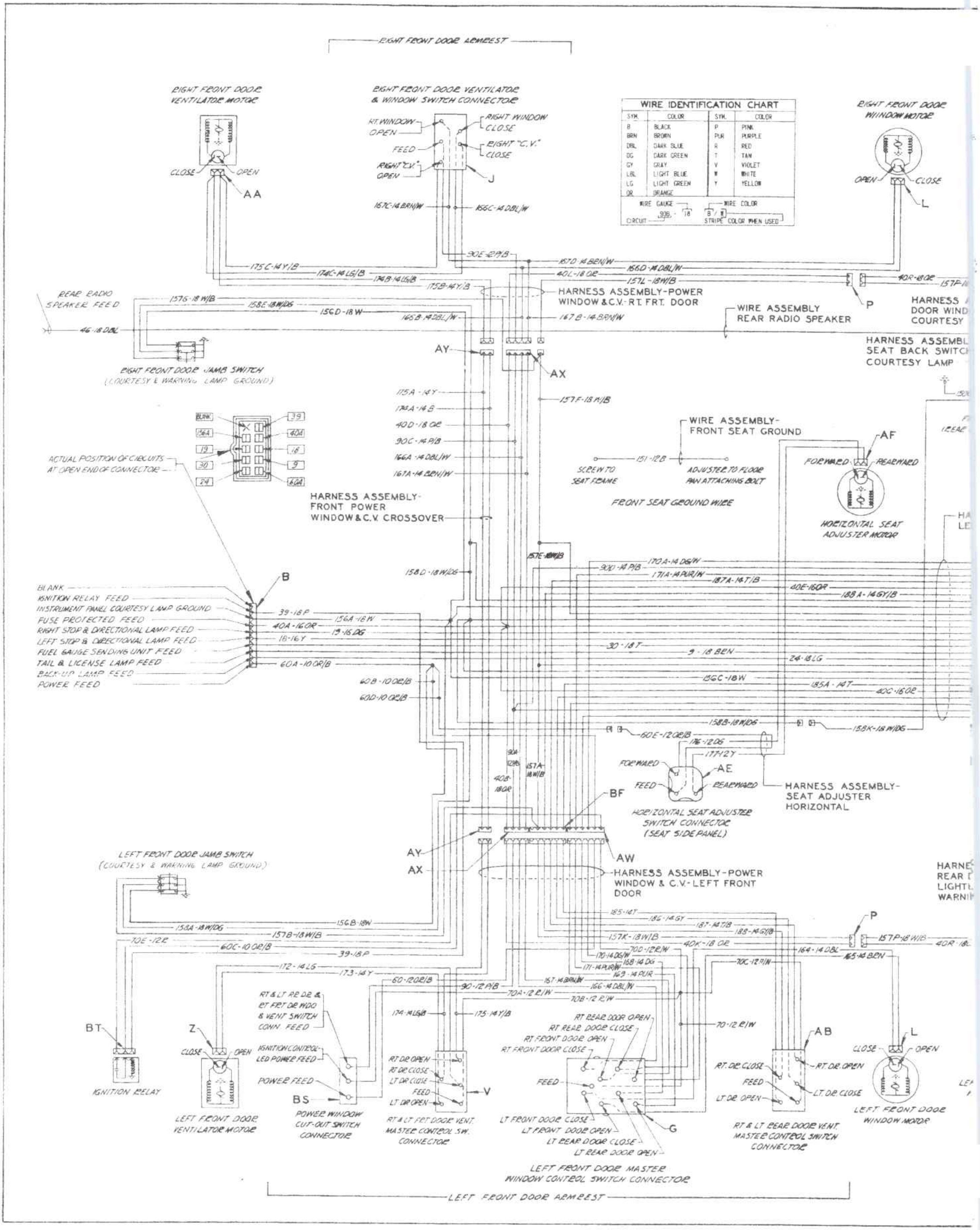


Fig. 12-56 Body Wiring Diagram (68069)

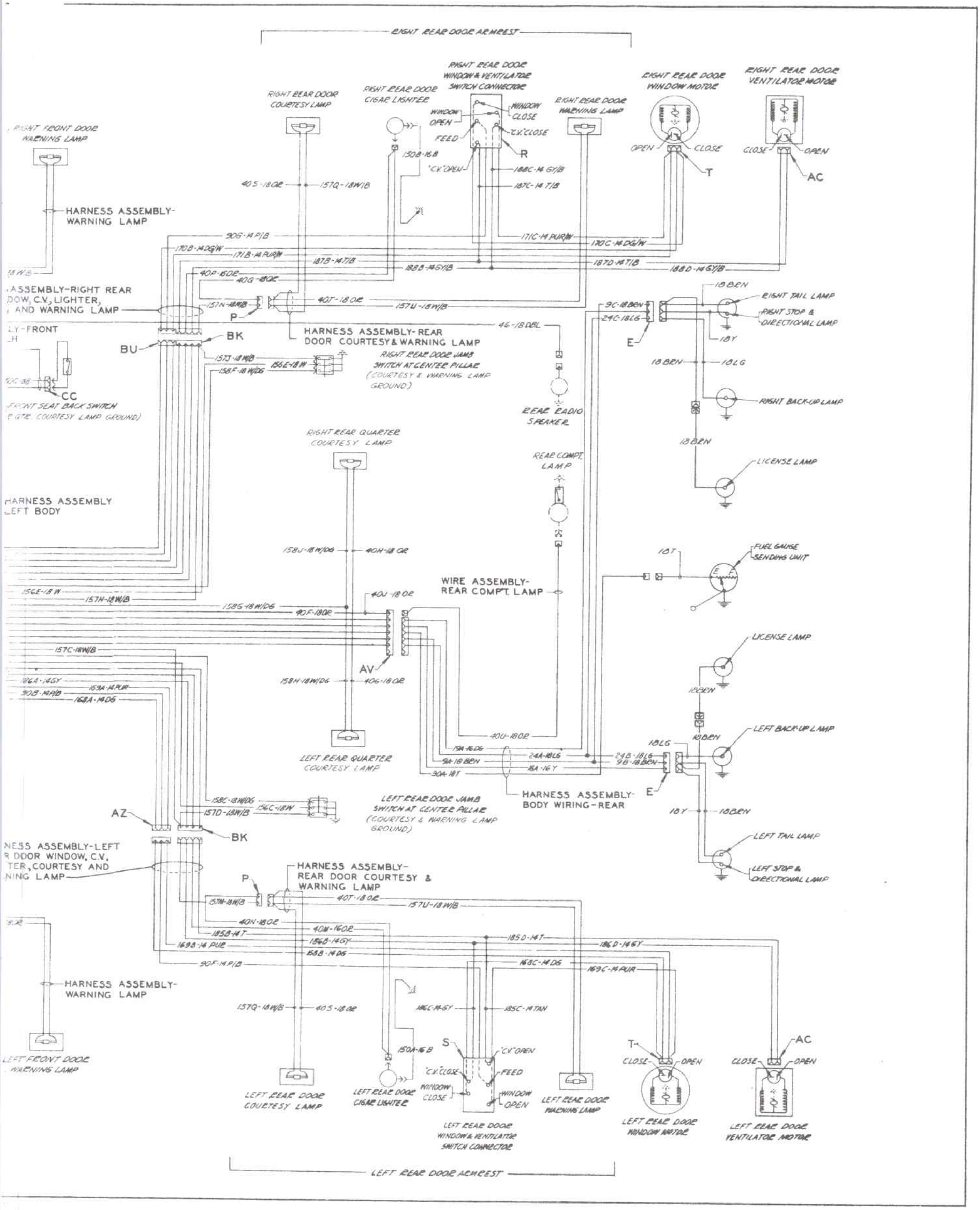


Fig. 12-56 Body Wiring Diagram (68069)

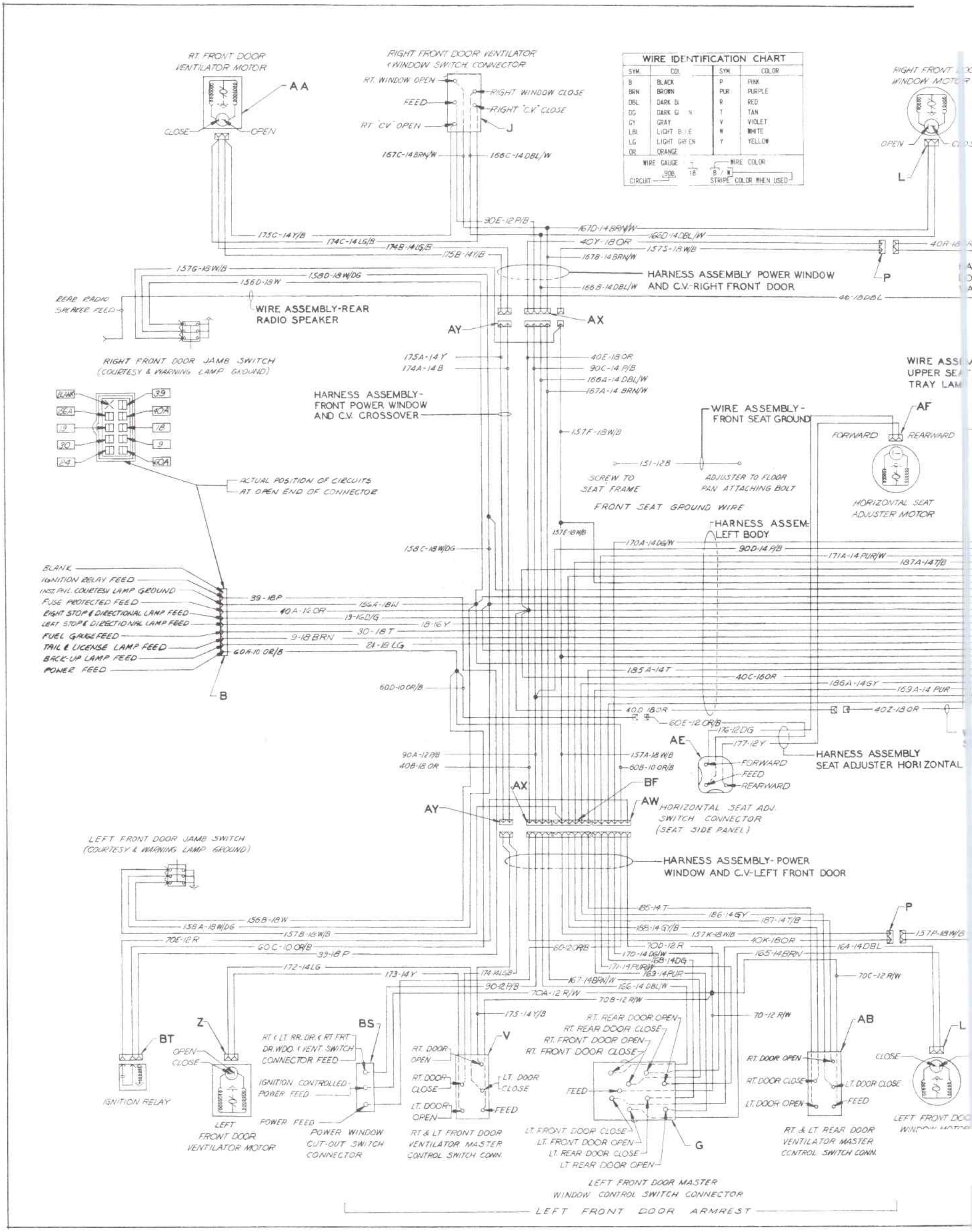


Fig. 12-57 Body Wiring Diagram (68169)

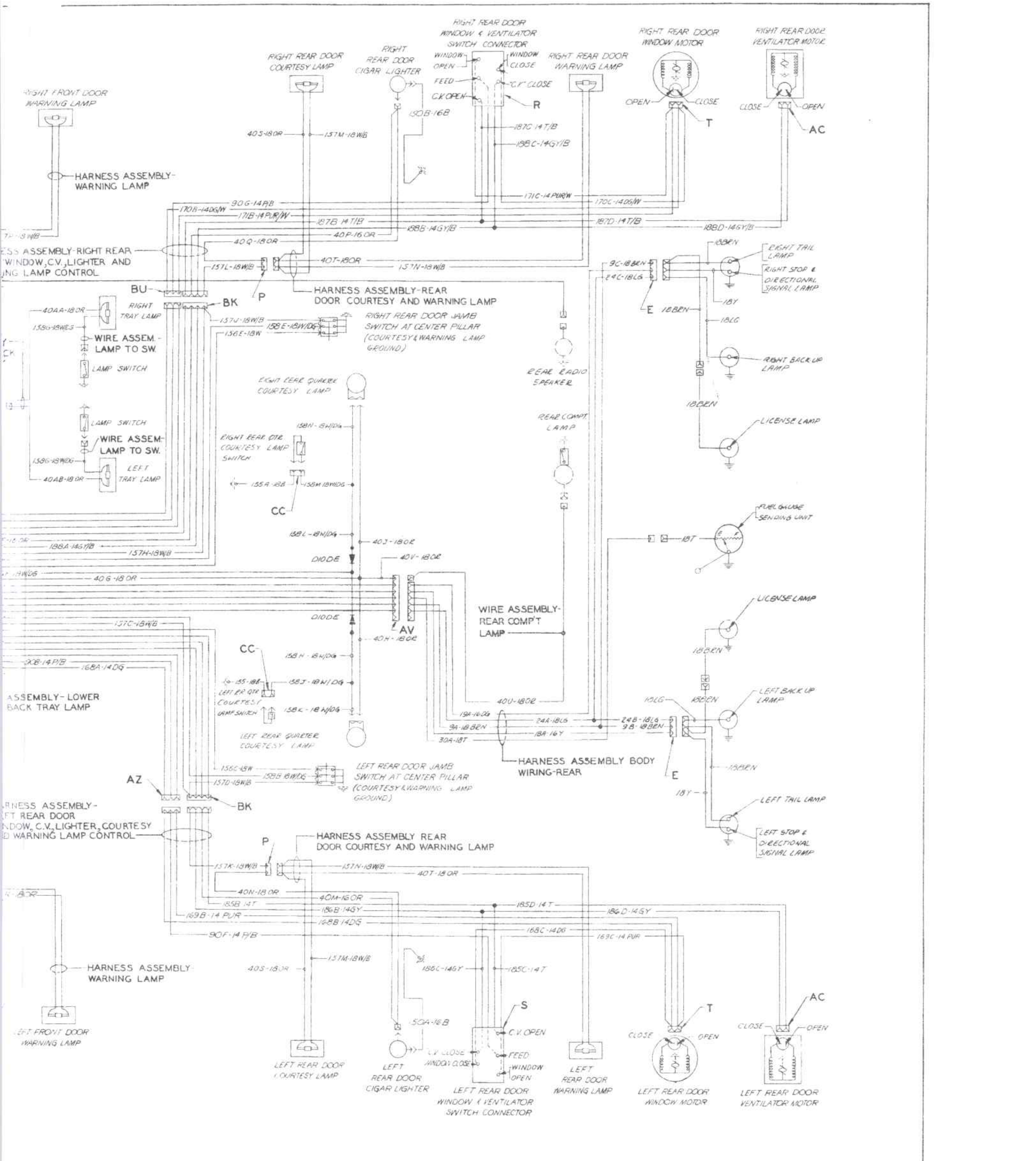


Fig. 12-57 Body Wiring Diagram (68169)

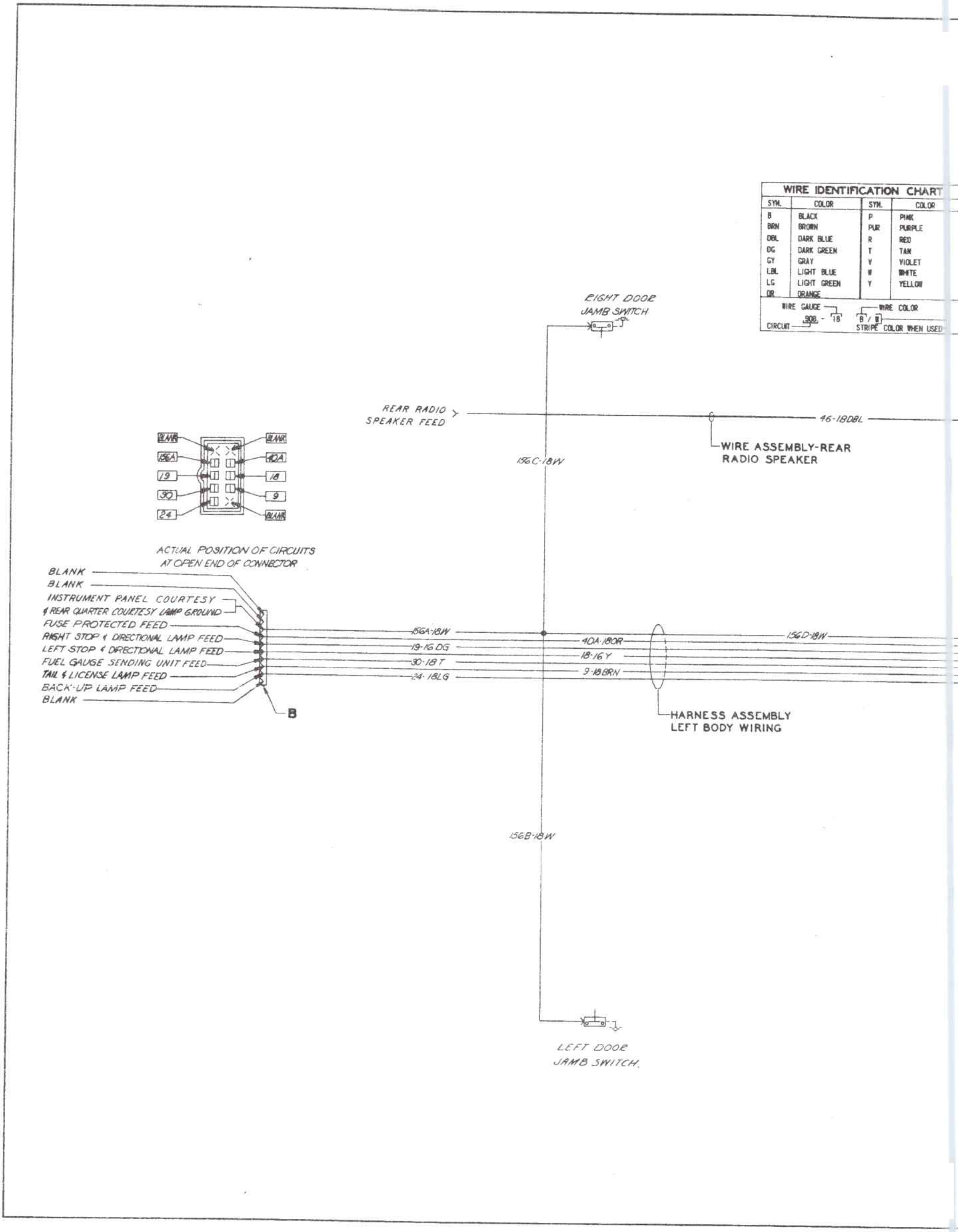


Fig. 12-58 Body Wiring Diagram (68247)

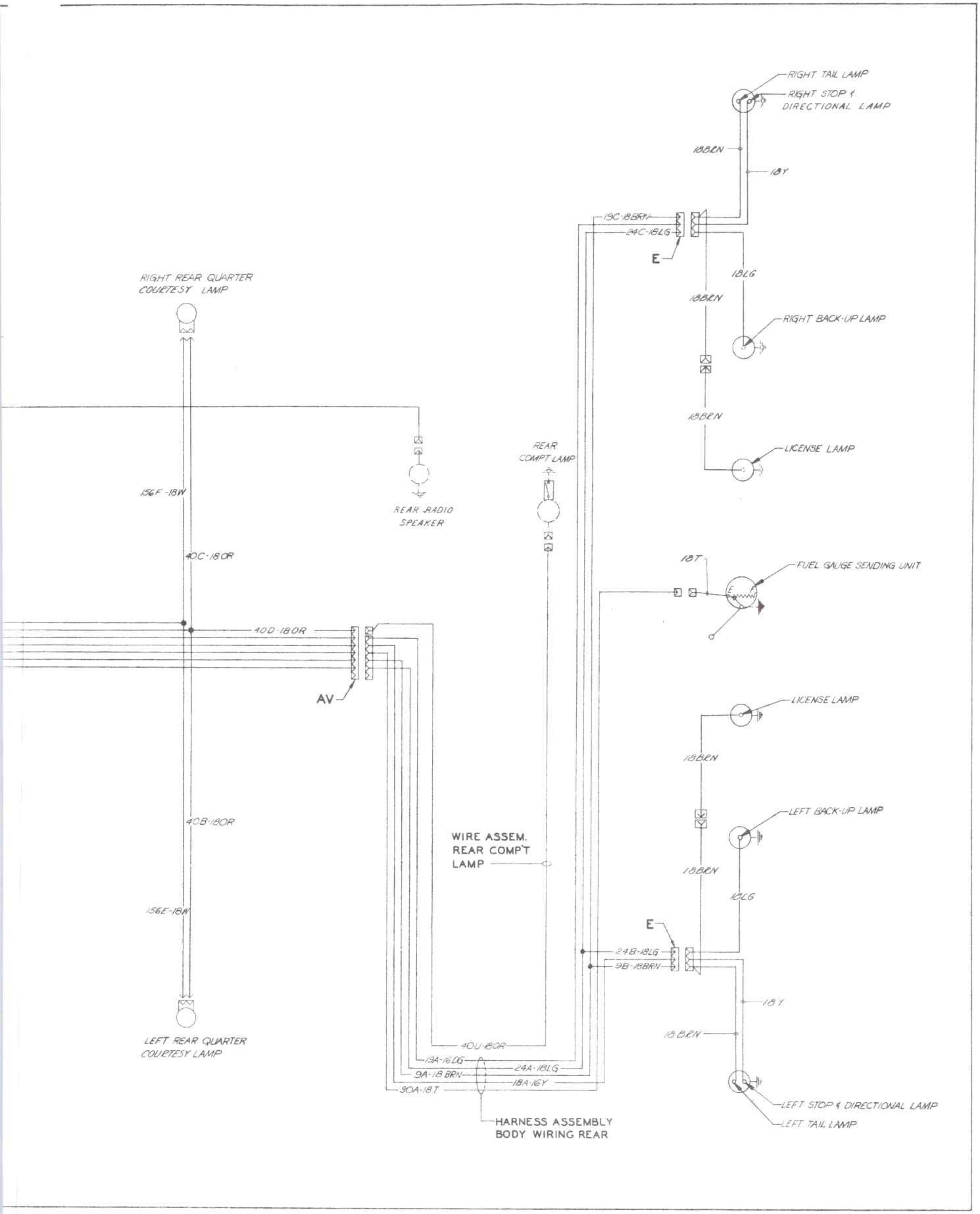
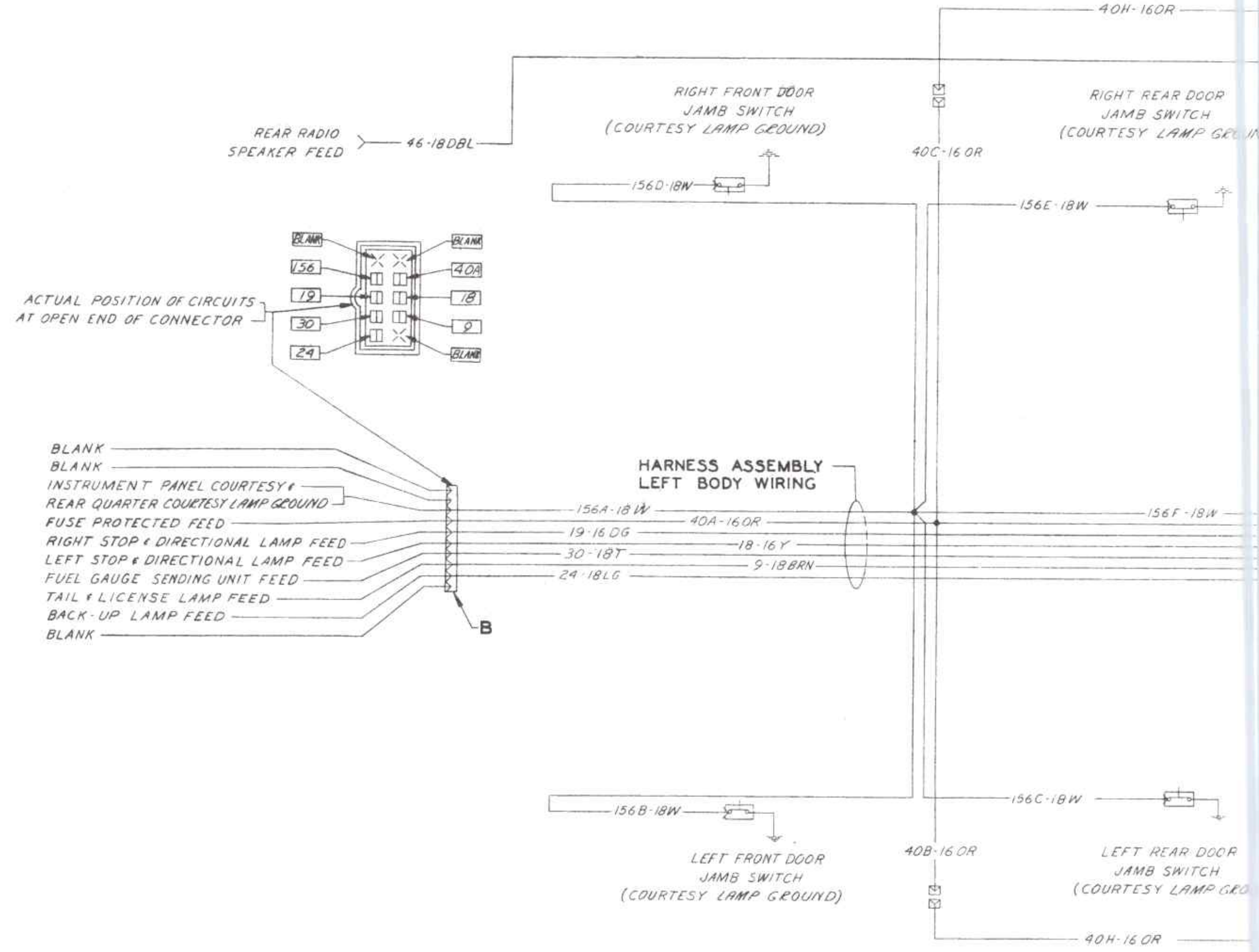


Fig. 12-58 Body Wiring Diagram (68247)



WIRE IDENTIFICATION CHART

SYM.	COLOR	SYM.	COLOR
B	BLACK	P	PINK
BRN	BROWN	PUR	PURPLE
DBL	DARK BLUE	R	RED
DG	DARK GREEN	T	TAN
GY	GRAY	V	VIOLET
LBL	LIGHT BLUE	W	WHITE
LG	LIGHT GREEN	Y	YELLOW
OR	ORANGE		

WIRE GAUGE — 90B - 18 — CIRCUIT; WIRE COLOR — B / W — STRIPE COLOR WHEN USED

Fig. 12-59 Body Wiring Diagram (68249, 68269)

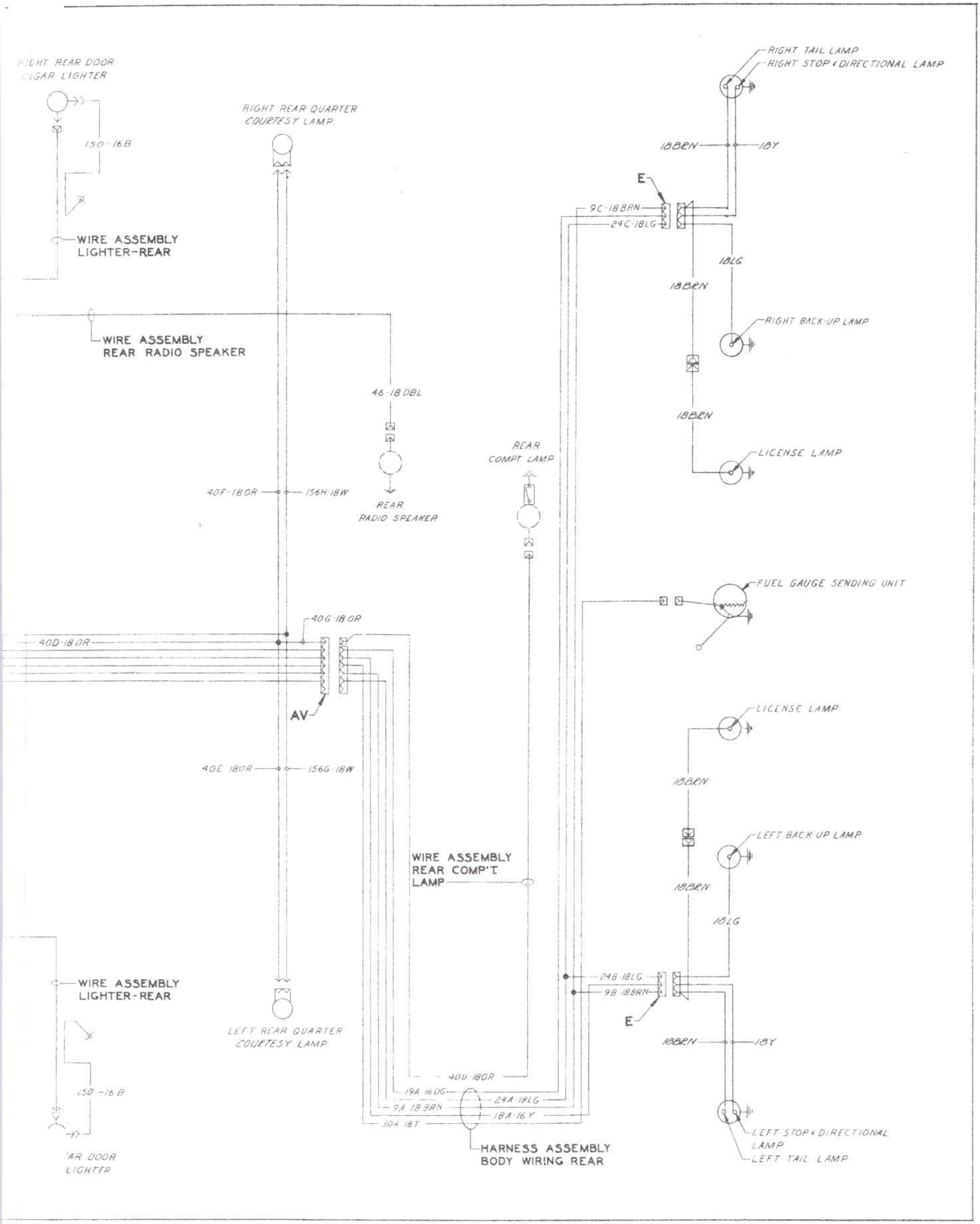


Fig. 12-59 Body Wiring Diagram (68249, 68269)

WIRE IDENTIFICATION CHART

SYM.	COLOR	SYM.	COLOR
B	BLACK	P	PINK
BRN	BROWN	PUR	PURPLE
DBL	DARK BLUE	R	RED
DG	DARK GREEN	T	TAN
GY	GRAY	V	VIOLET
LBL	LIGHT BLUE	W	WHITE
LG	LIGHT GREEN	Y	YELLOW
OR	ORANGE		

WIRE GAUGE — CIRCUIT 90B - 18 — WIRE COLOR B / W — STRIPE COLOR WHEN USED

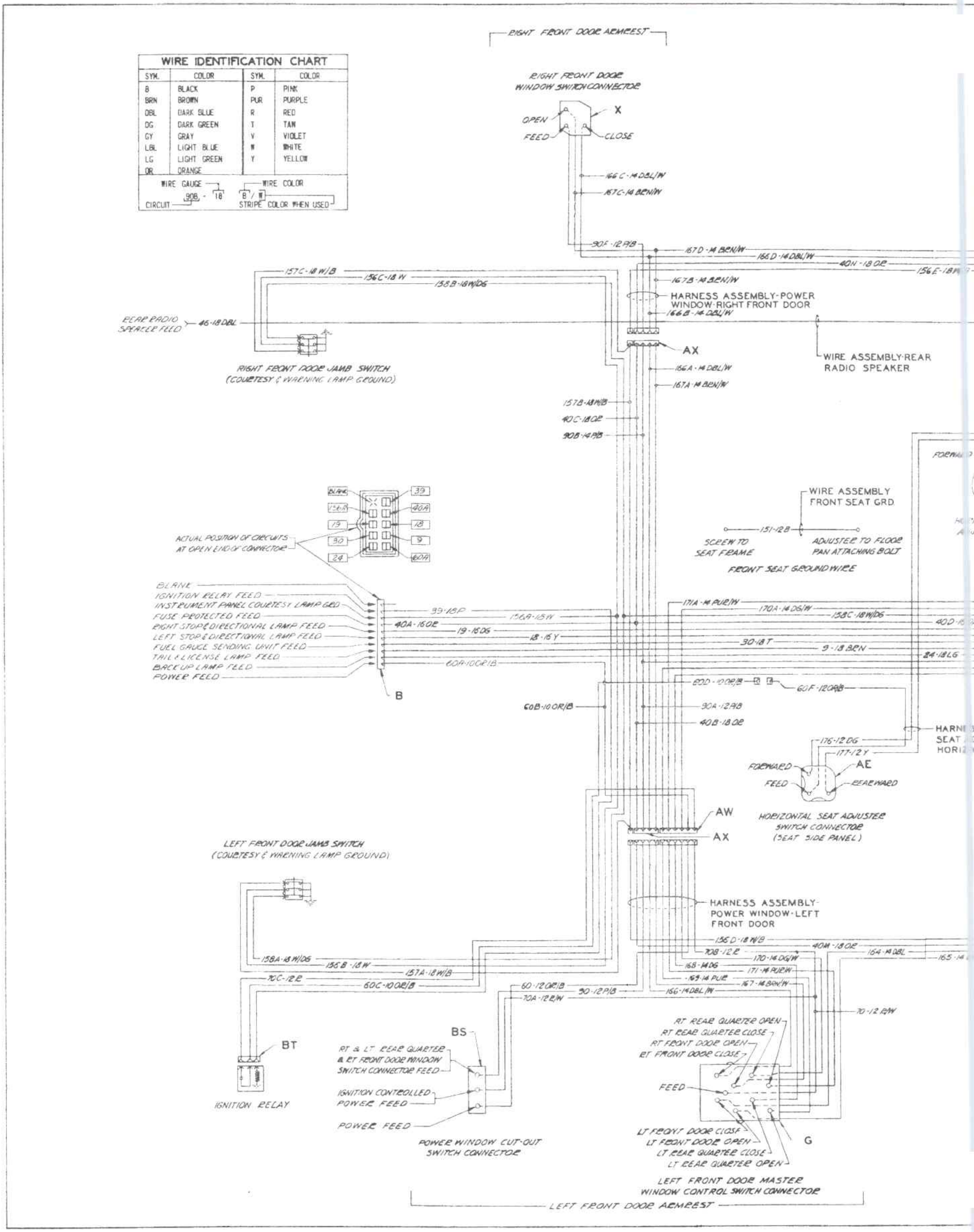


Fig. 12-60 Body Wiring Diagram (68347)

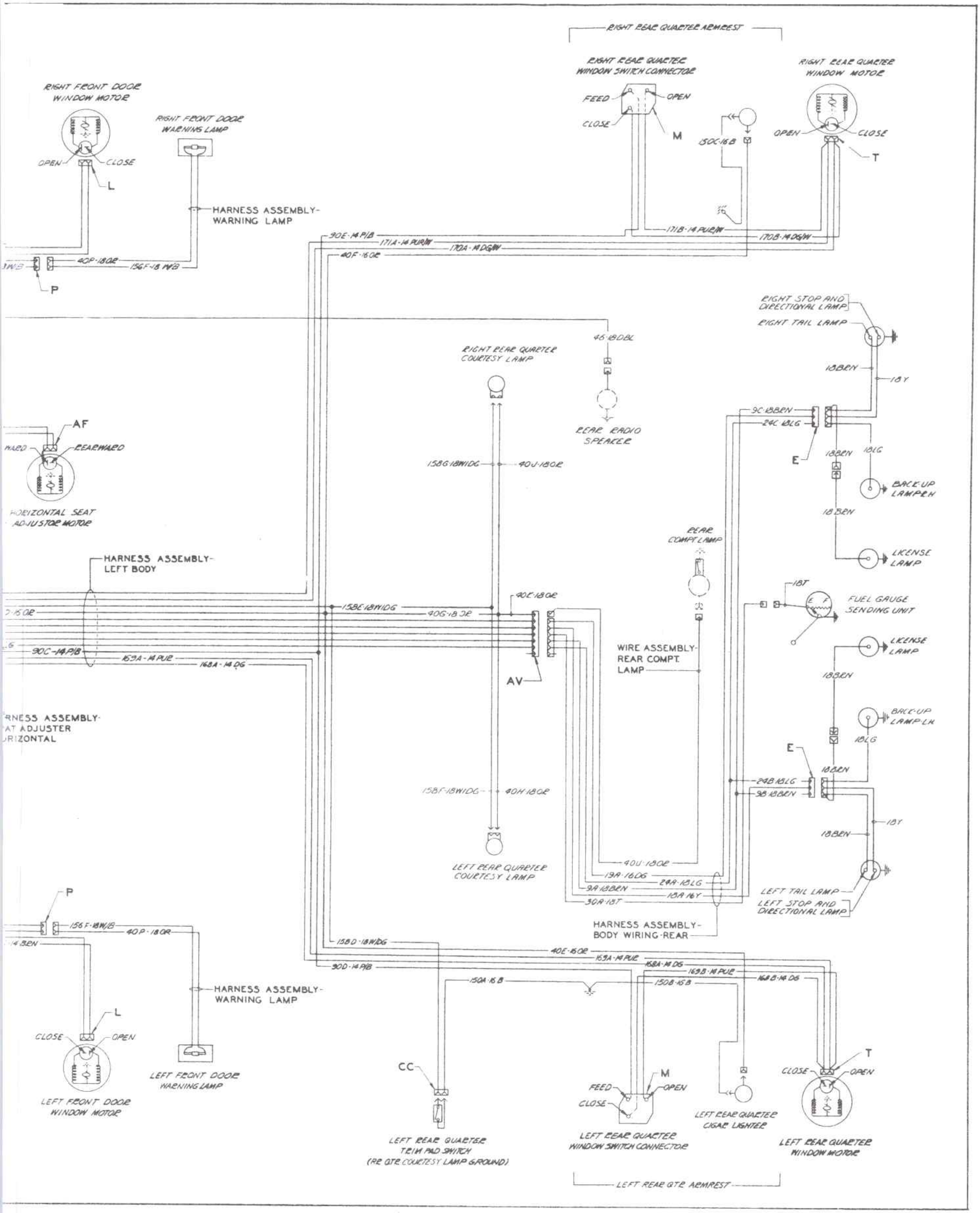


Fig. 12-60 Body Wiring Diagram (63847)

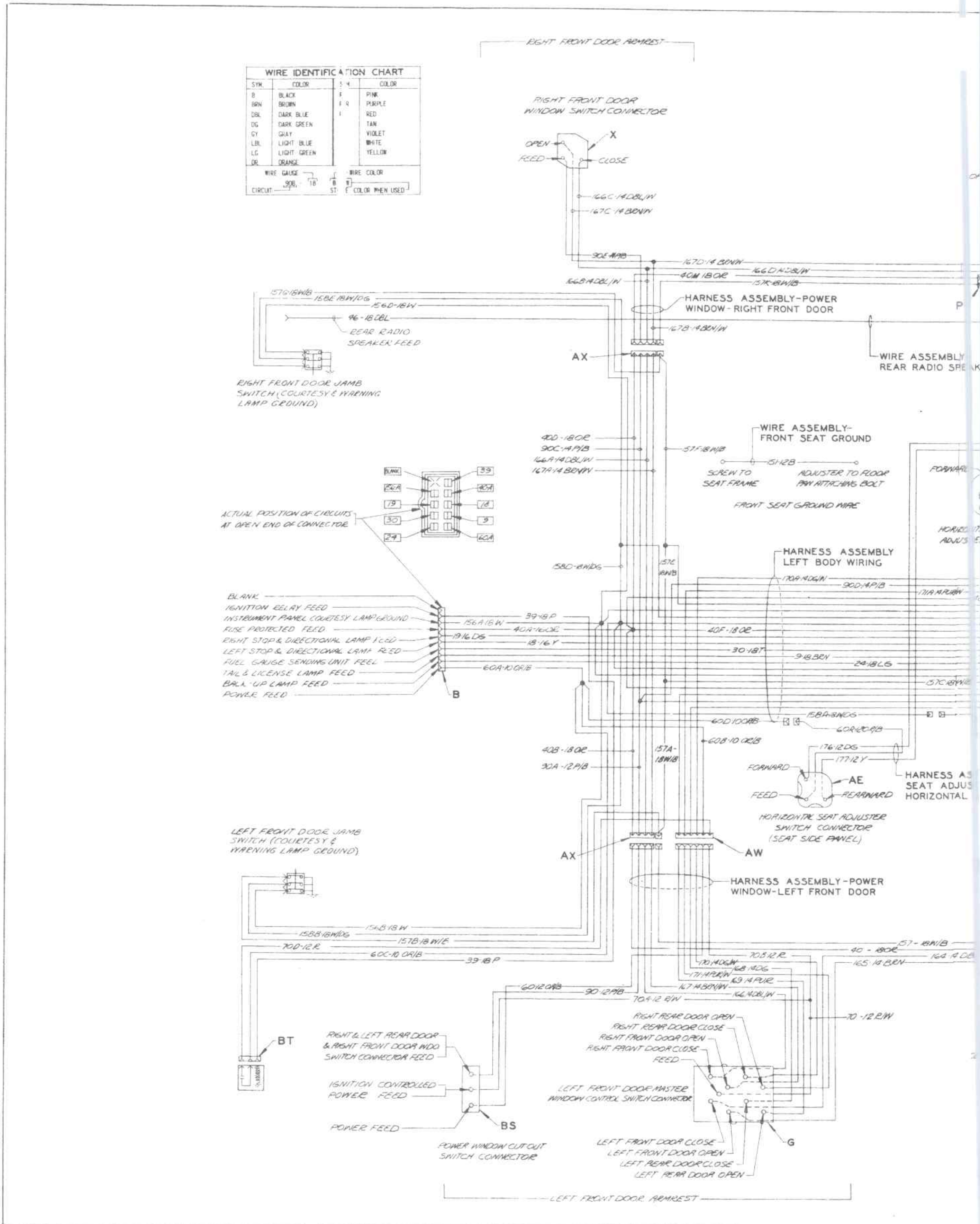


Fig. 12-61 Body Wiring Diagram (68349, 68369)

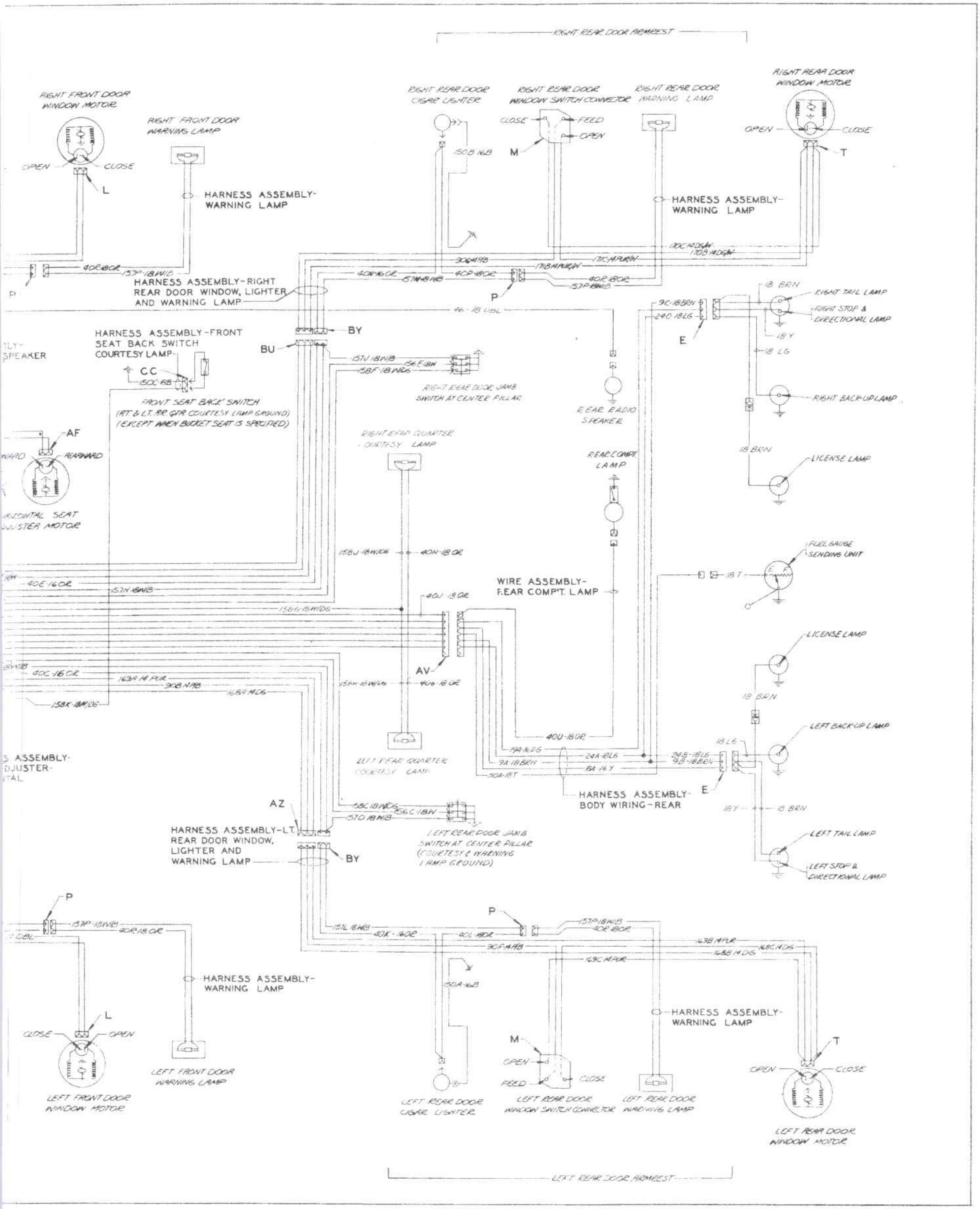


Fig. 12-61 Body Wiring Diagram (63849, 68369)

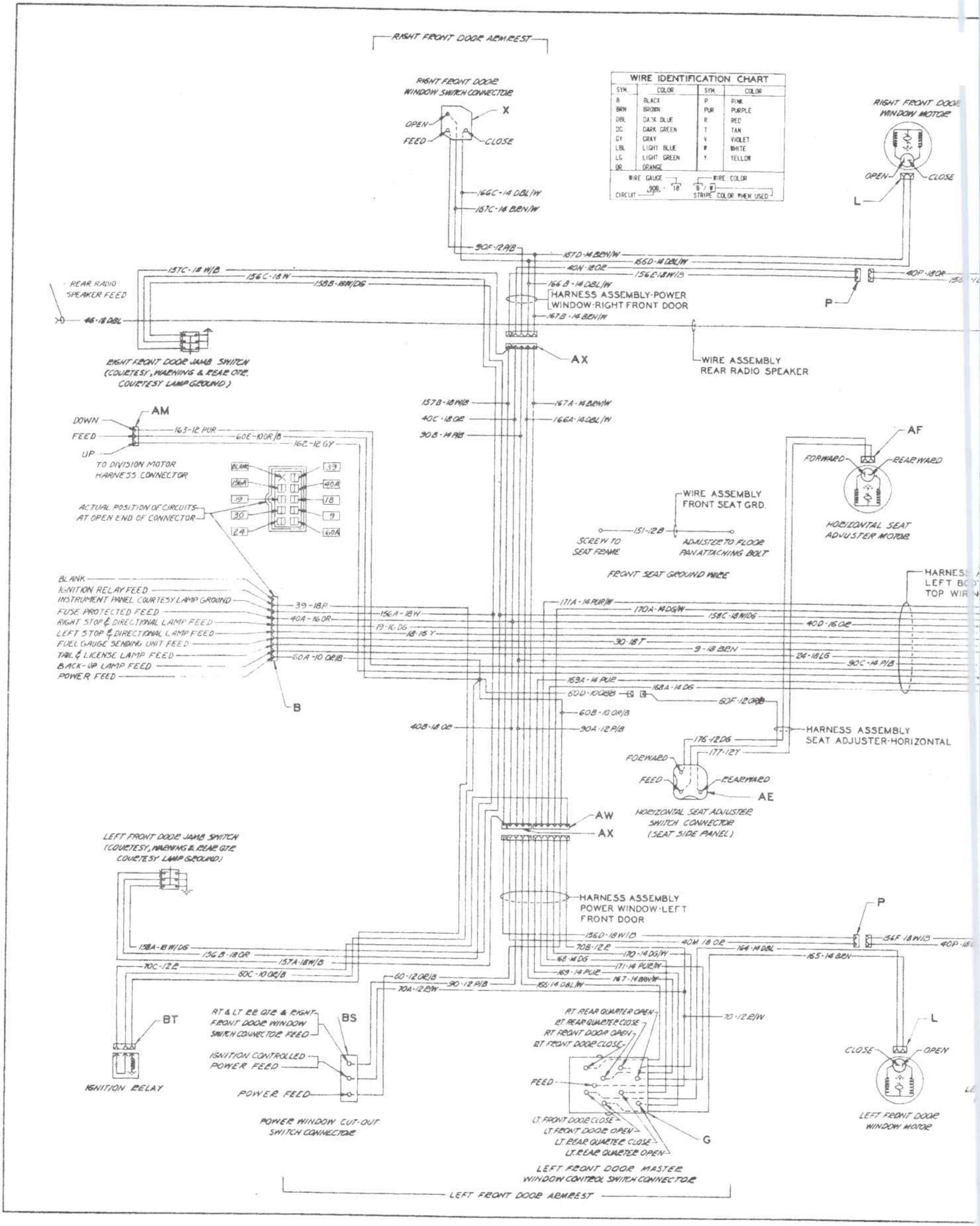


Fig. 12-62 Body Wiring Diagram (68367)

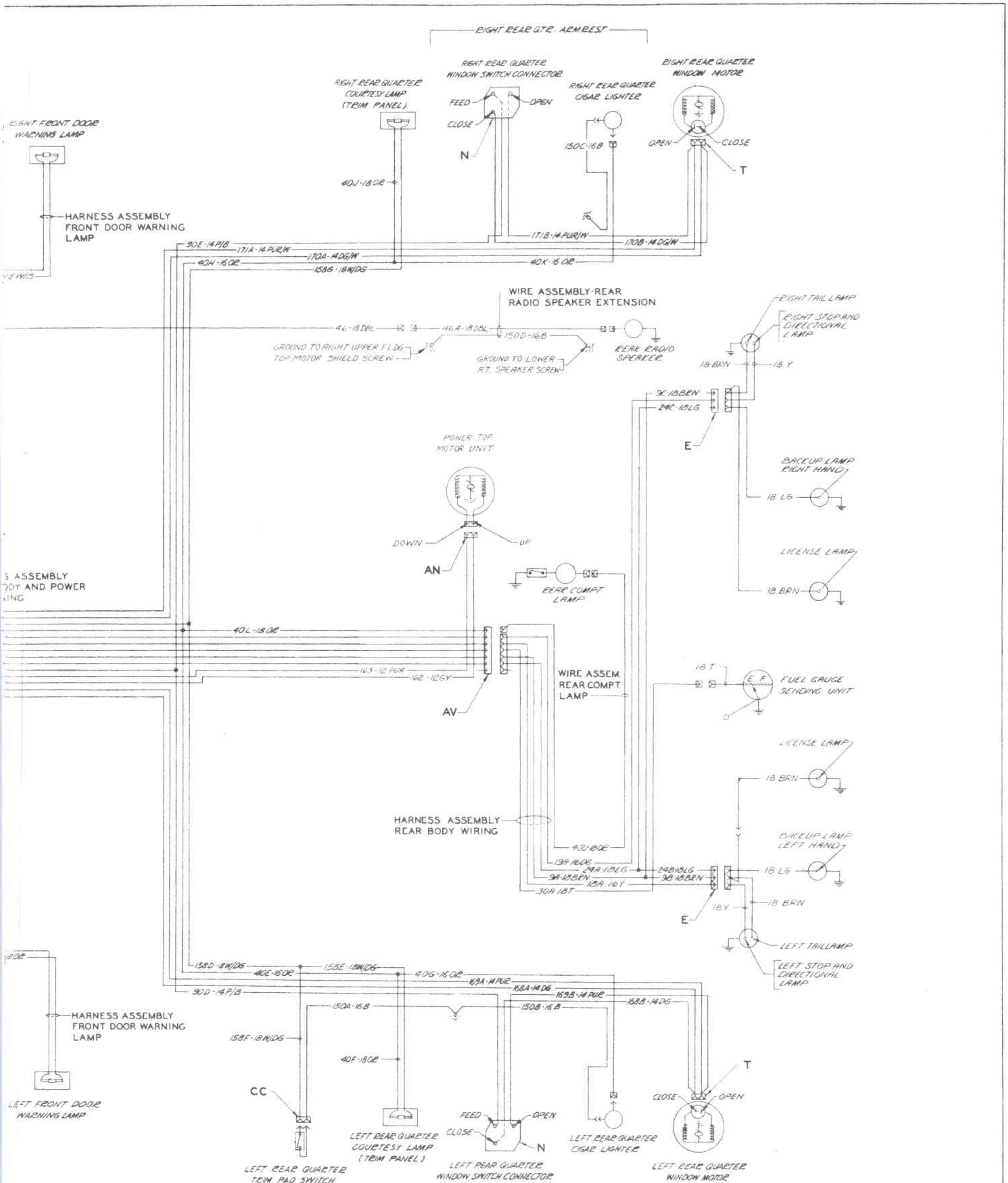


Fig. 12-62 Body Wiring Diagram (68367)

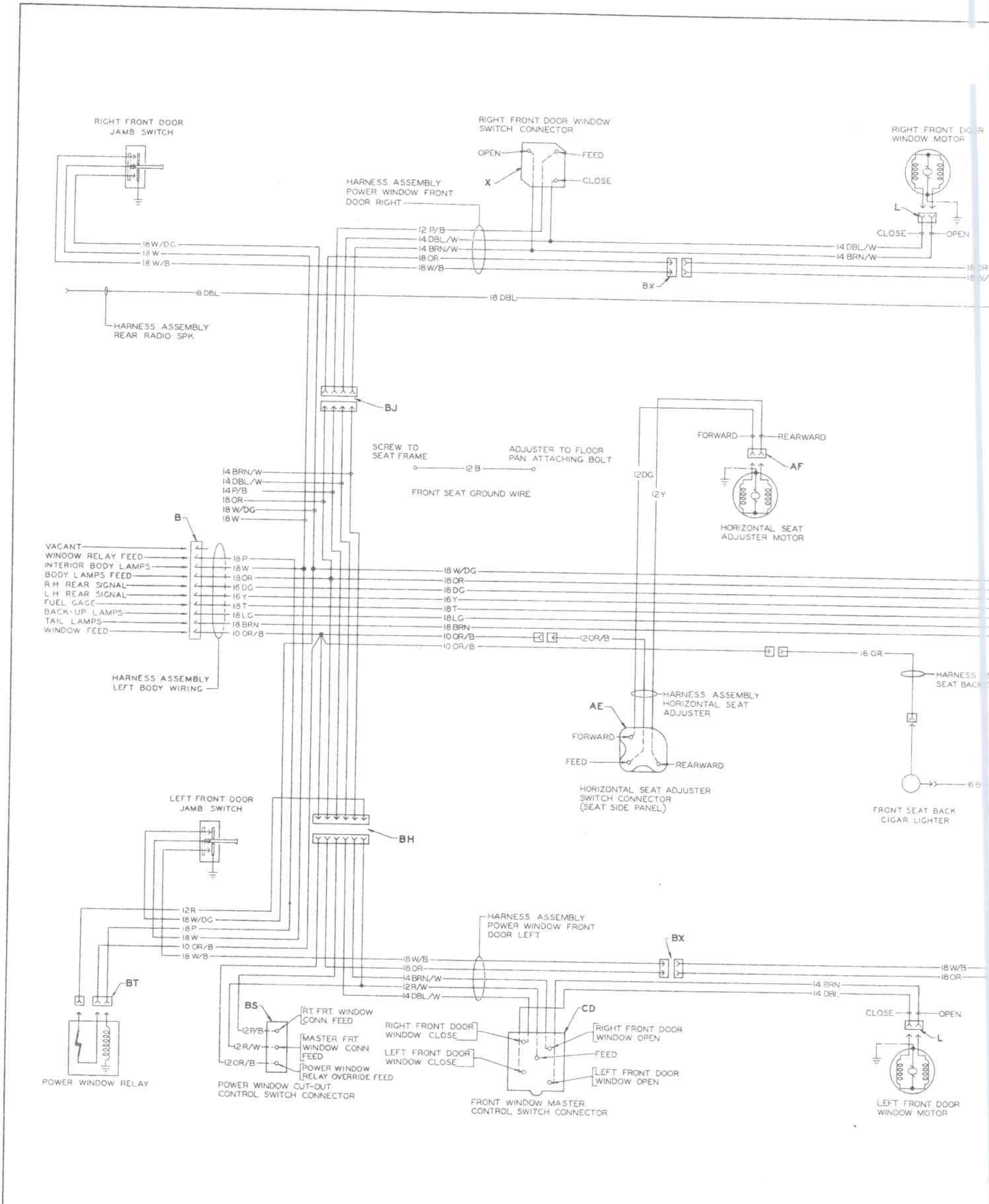
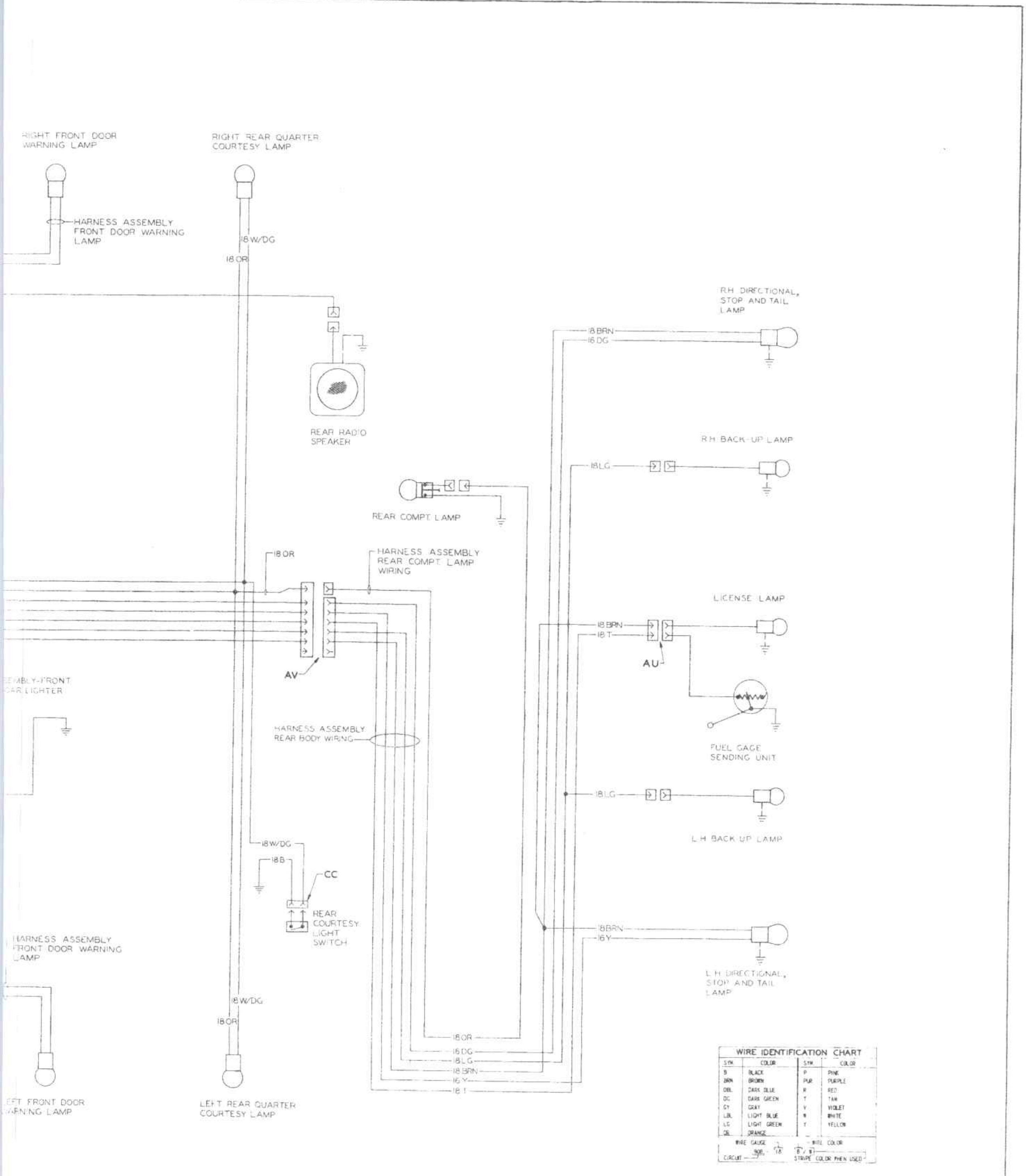


Fig. 12-63 Body Wiring Diagram (69347)



WIRE IDENTIFICATION CHART

SYM	COLOR	SYM	COLOR
B	BLACK	P	PINK
BRN	BROWN	PUR	PURPLE
DBL	DARK BLUE	R	RED
DG	DARK GREEN	T	TAN
GY	GRAY	V	VIOLET
LBL	LIGHT BLUE	W	WHITE
LG	LIGHT GREEN	Y	YELLOW
OR	ORANGE		

Fig. 12-63 Body Wiring Diagram (69347)

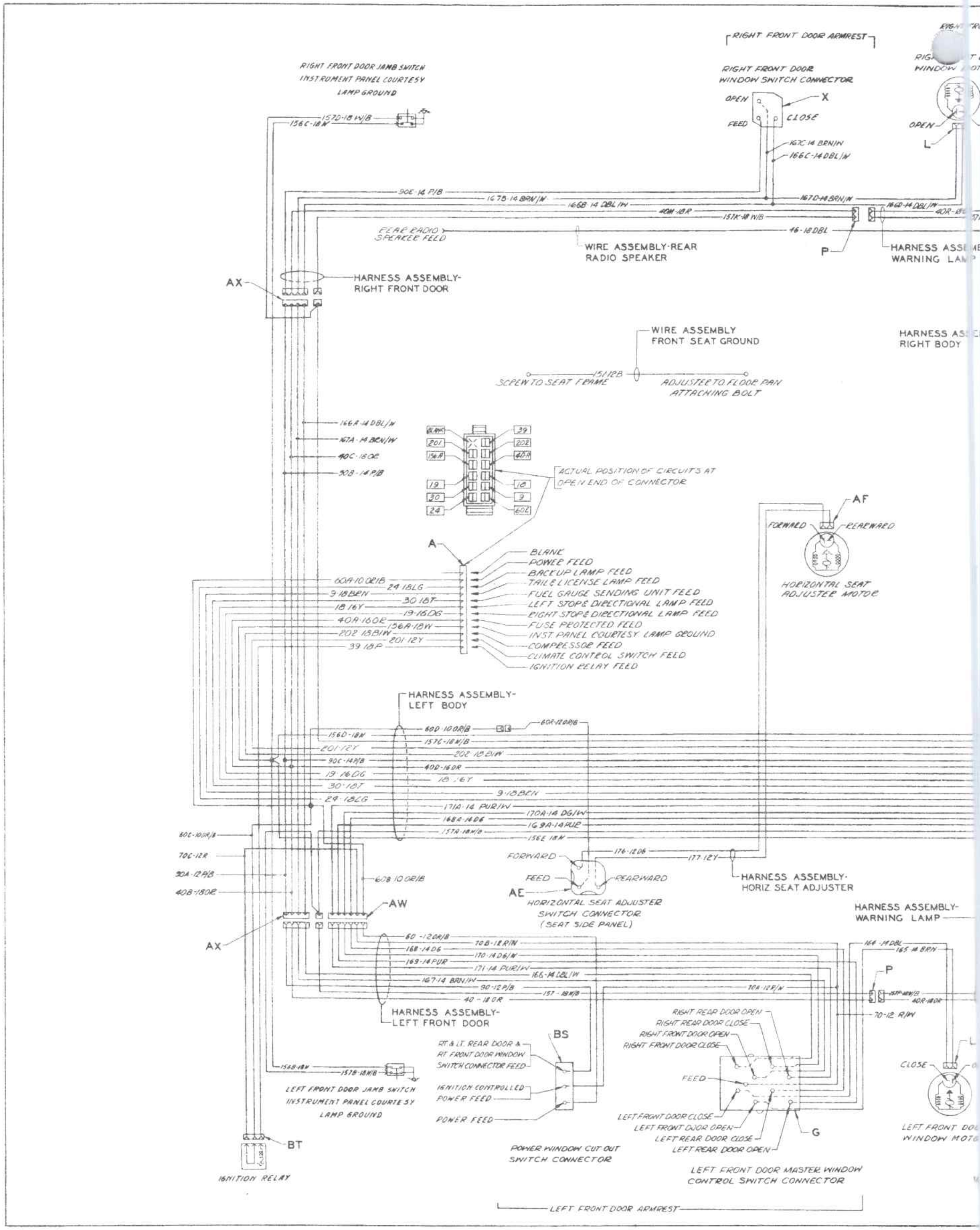


Fig. 12-64 Body Wiring Diagram (69723)

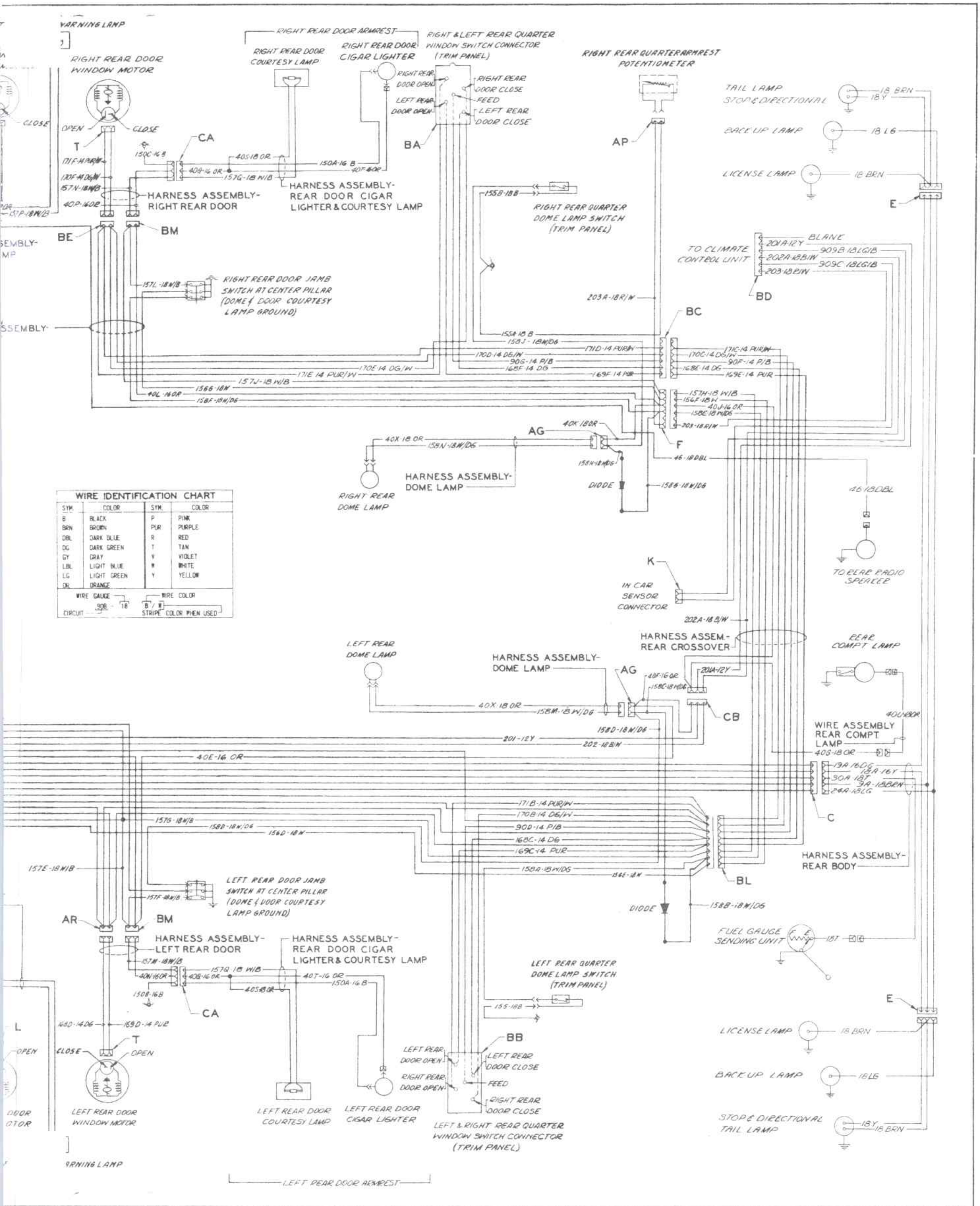


Fig. 12-64 Body Wiring Diagram (69723)

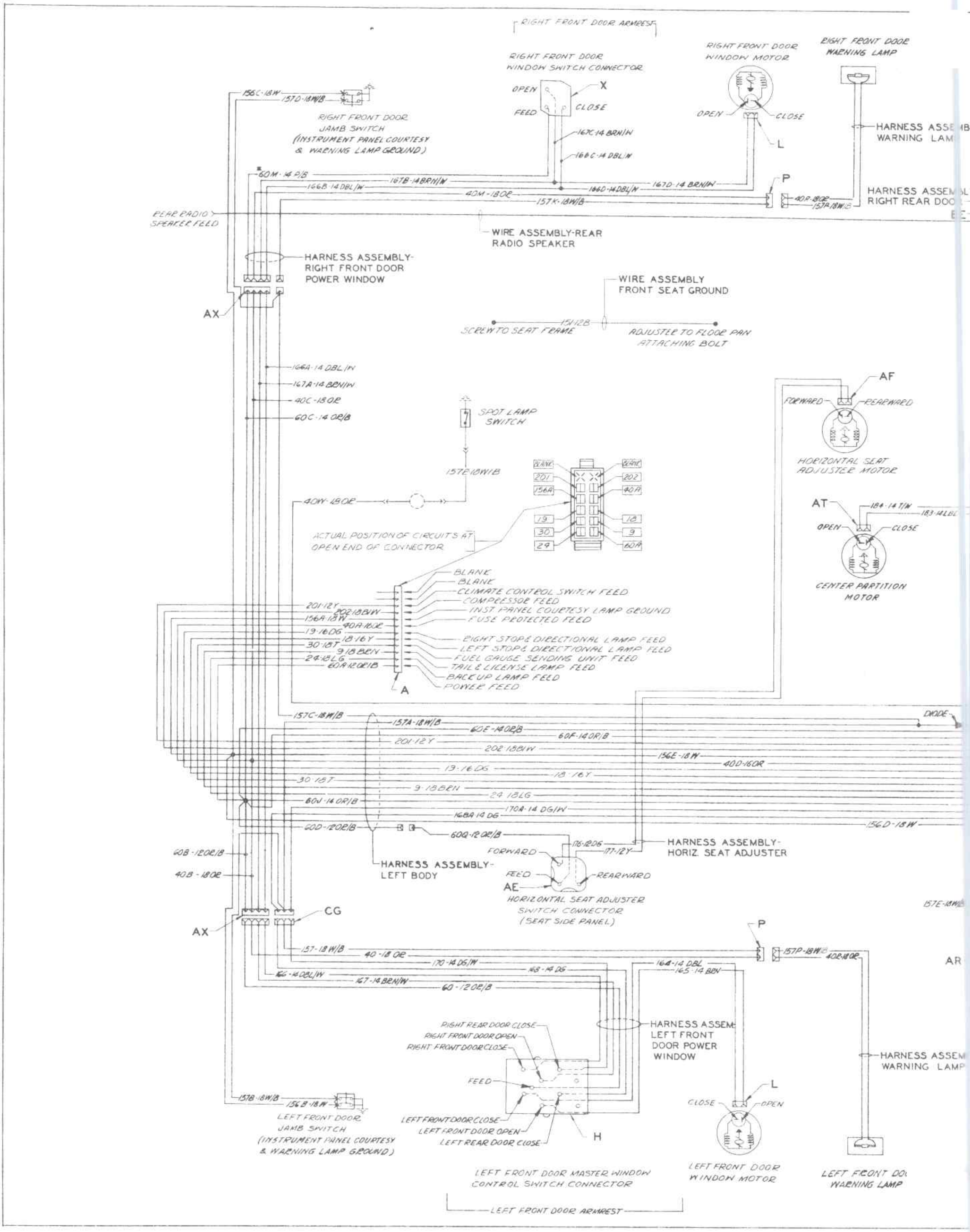
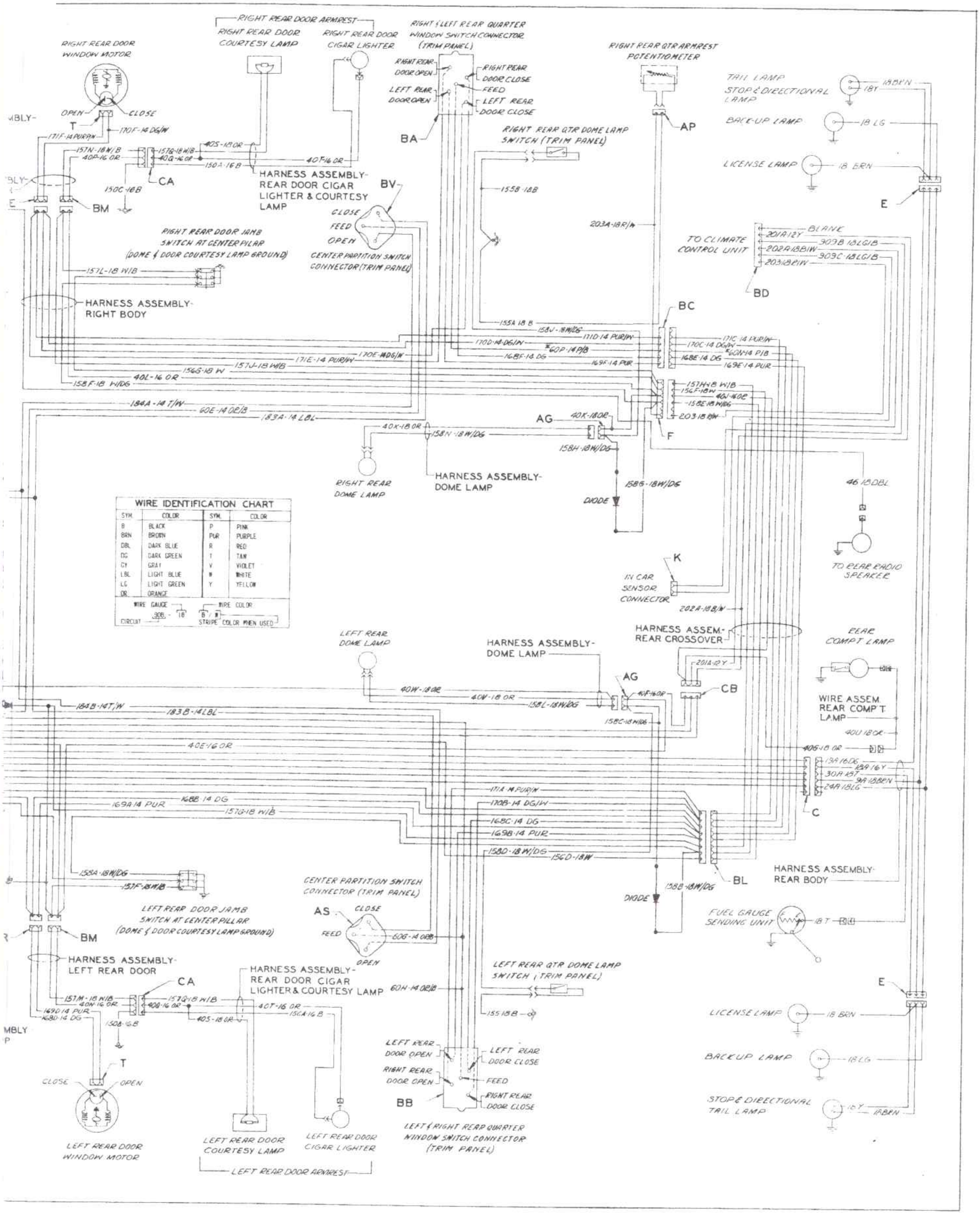


Fig. 12-65 Body Wiring Diagram (69733)



WIRE IDENTIFICATION CHART

SYM.	COLOR	SYM.	COLOR
B	BLACK	P	PINK
BRN	BROWN	PUR	PURPLE
DBL	DARK BLUE	R	RED
DG	DARK GREEN	T	TAN
GY	GRAY	V	VIOLET
LBL	LIGHT BLUE	W	WHITE
LG	LIGHT GREEN	Y	YELLOW
OR	ORANGE		

WIRE GAUGE — 908 - 18 — CIRCUIT; WIRE COLOR — B / W — STRIPE COLOR WHEN USED

Fig. 12-65 Body Wiring Diagram (69733)

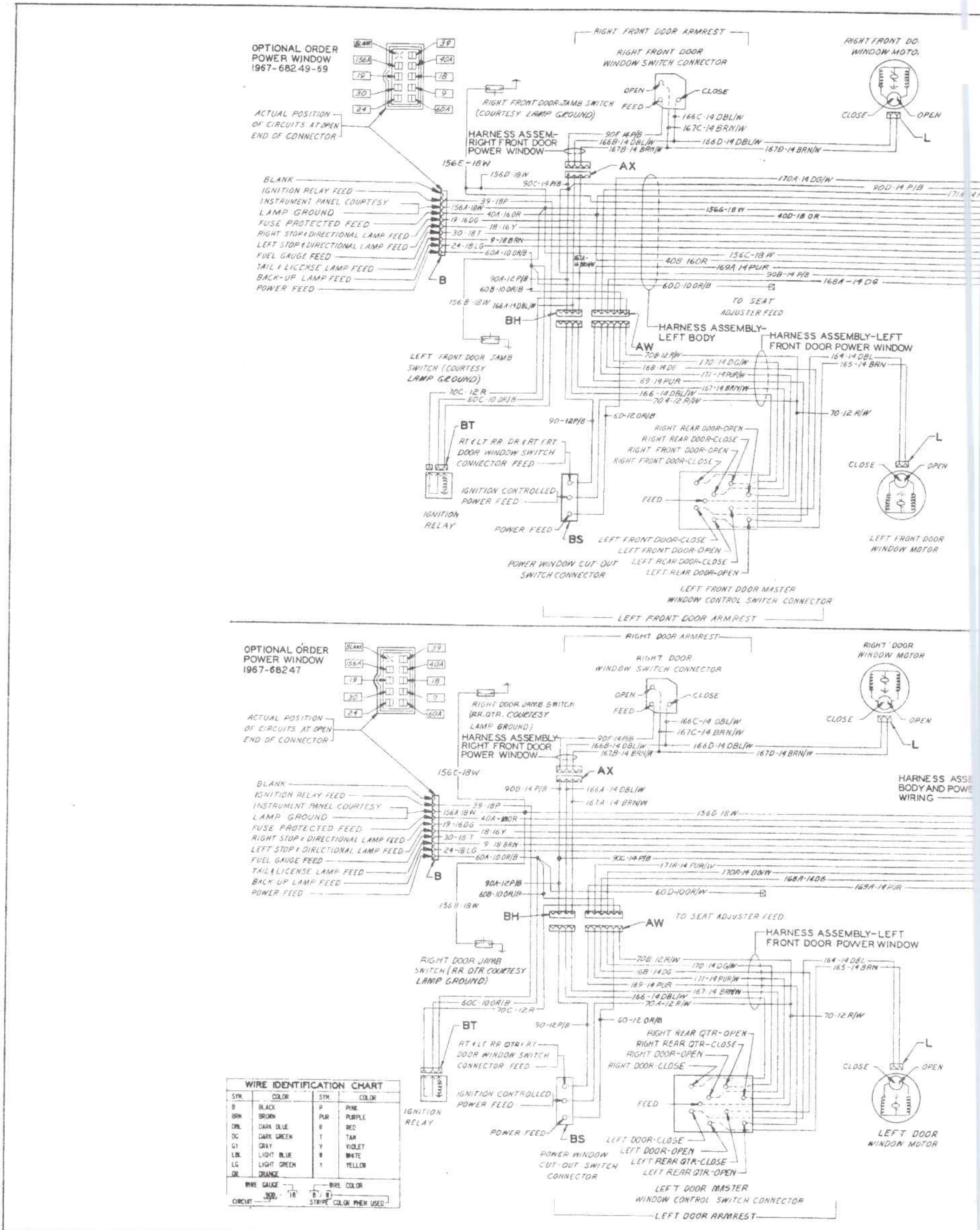


Fig. 12-66 Power Window Body Diagram (682 Styles)

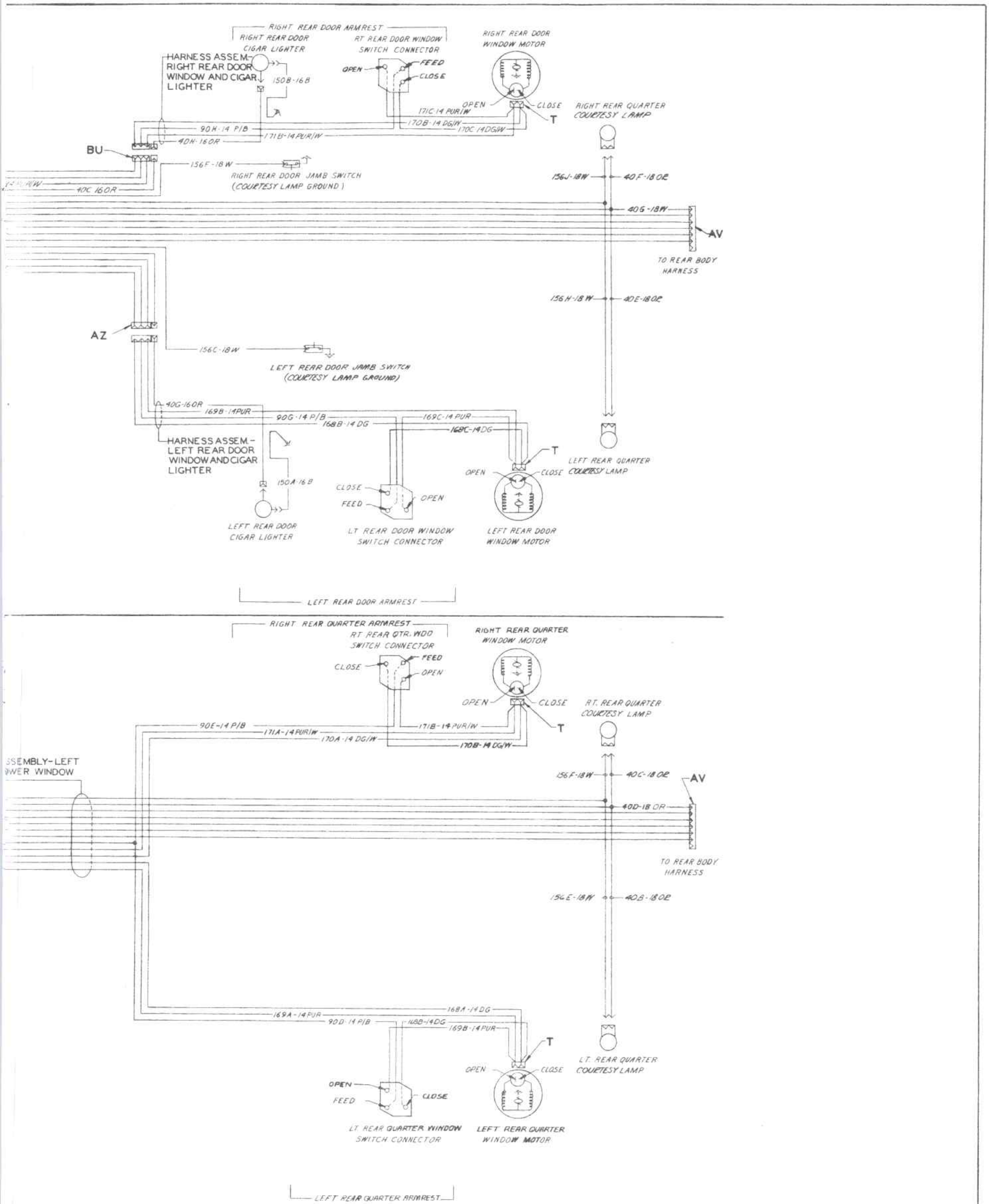
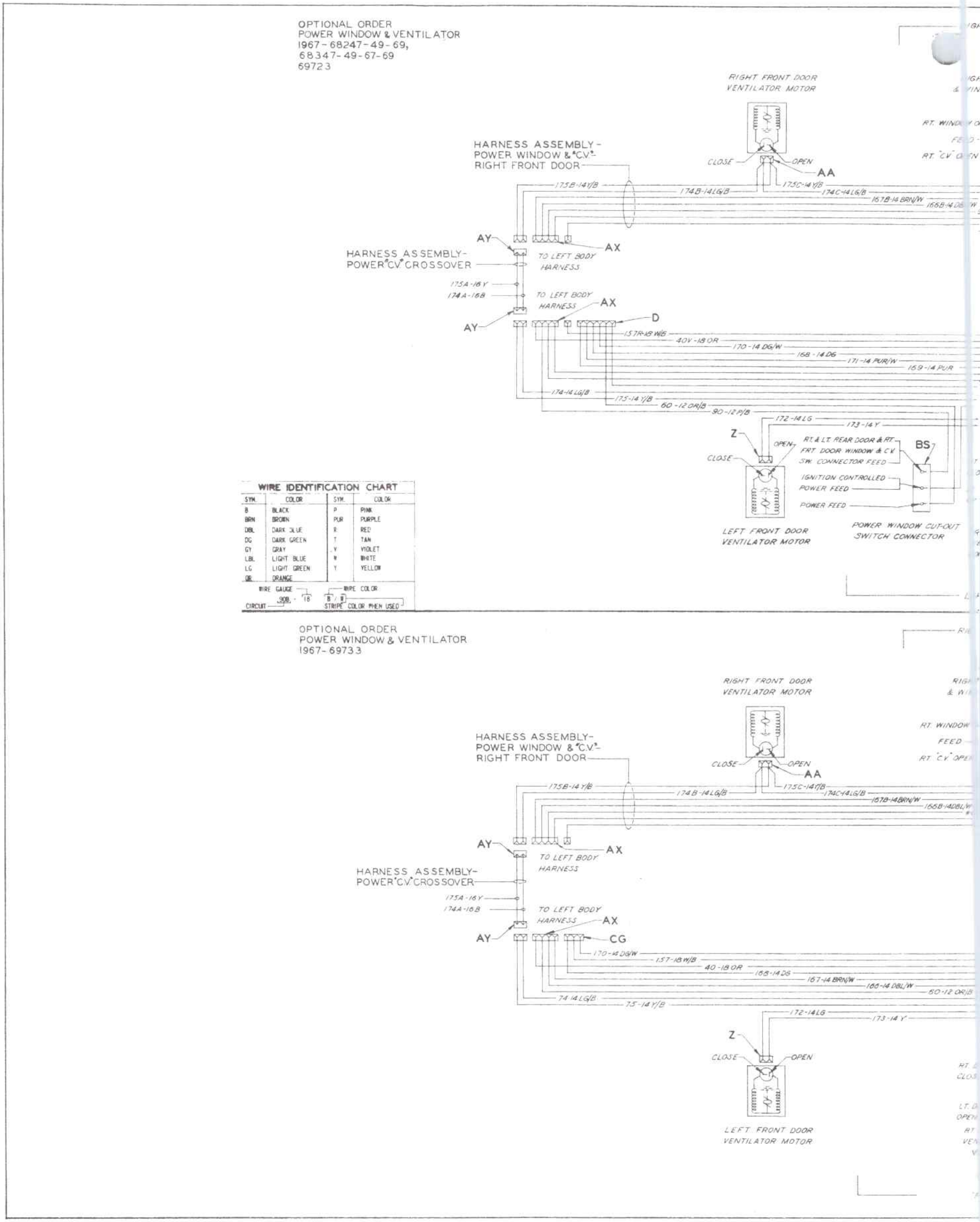


Fig. 12-66 Power Window Body Diagram (682 Styles)



WIRE IDENTIFICATION CHART

SYM.	COLOR	SYM.	COLOR
B	BLACK	P	PINK
BRN	BROWN	PUR	PURPLE
DBL	DARK BLUE	R	RED
DG	DARK GREEN	T	TAN
GY	GRAY	V	VIOLET
LBL	LIGHT BLUE	W	WHITE
LG	LIGHT GREEN	Y	YELLOW
OR	ORANGE		

WIRE GAUGE — WIRE COLOR — CIRCUIT 90B-18 B/W — STRIPE COLOR WHEN USED

Fig. 12-67 Power Window and Ventilator Body Diagram (682, 683 and 697 Styles)

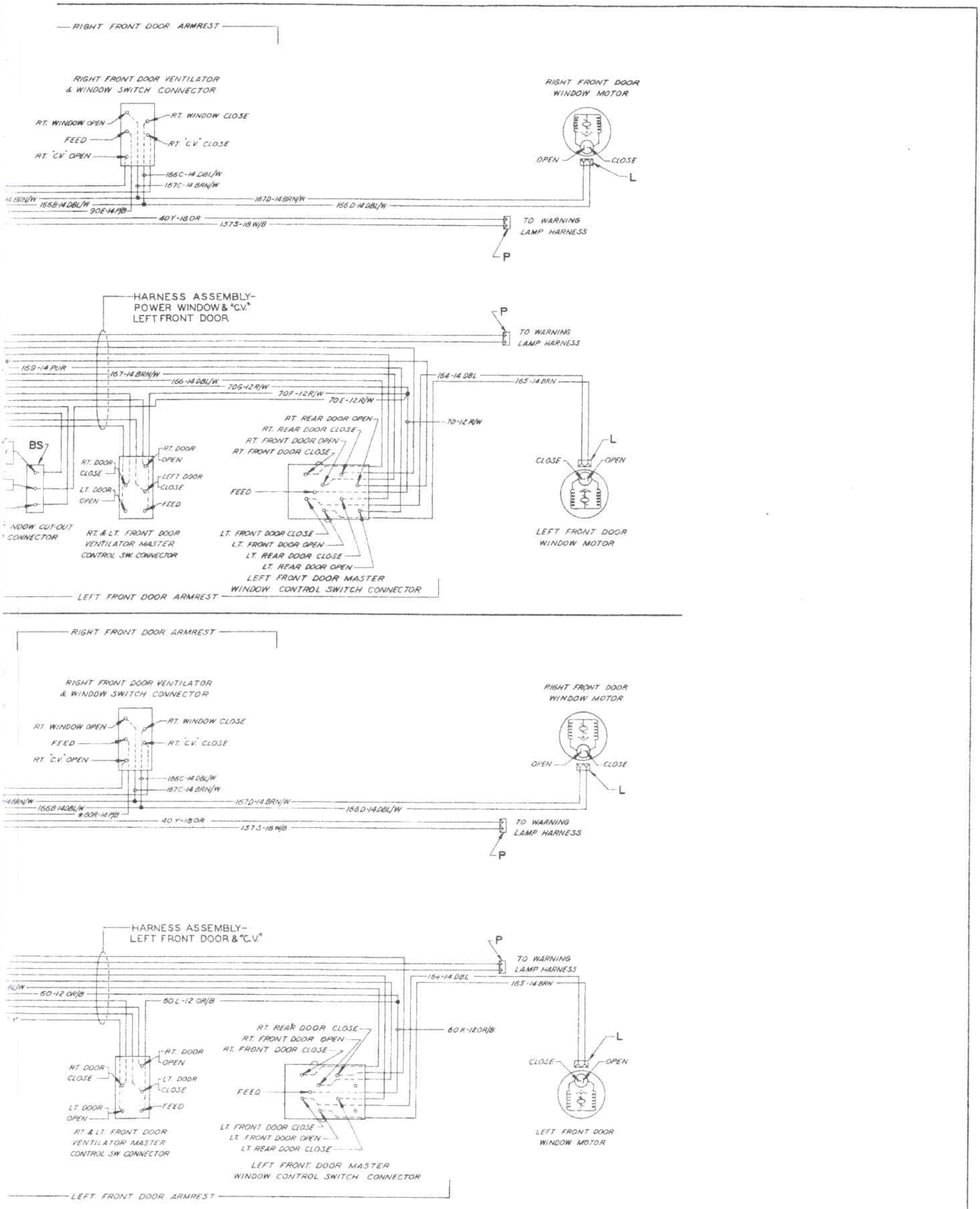


Fig. 12-67 Power Window and Ventilator Body Diagram (682, 683 and 697 Styles)

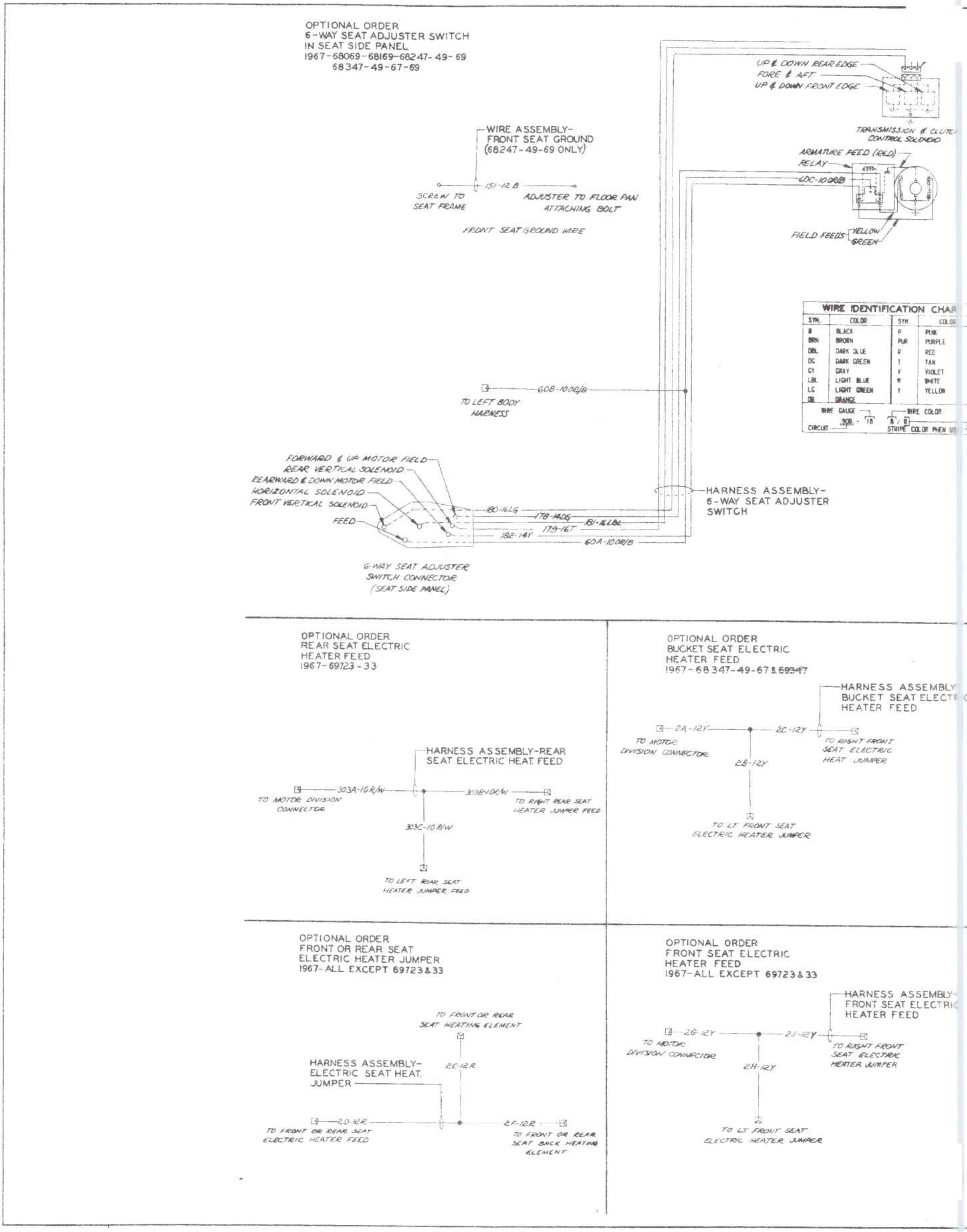


Fig. 12-68 Adjustable Seats and Seat Warmer Body Diagram

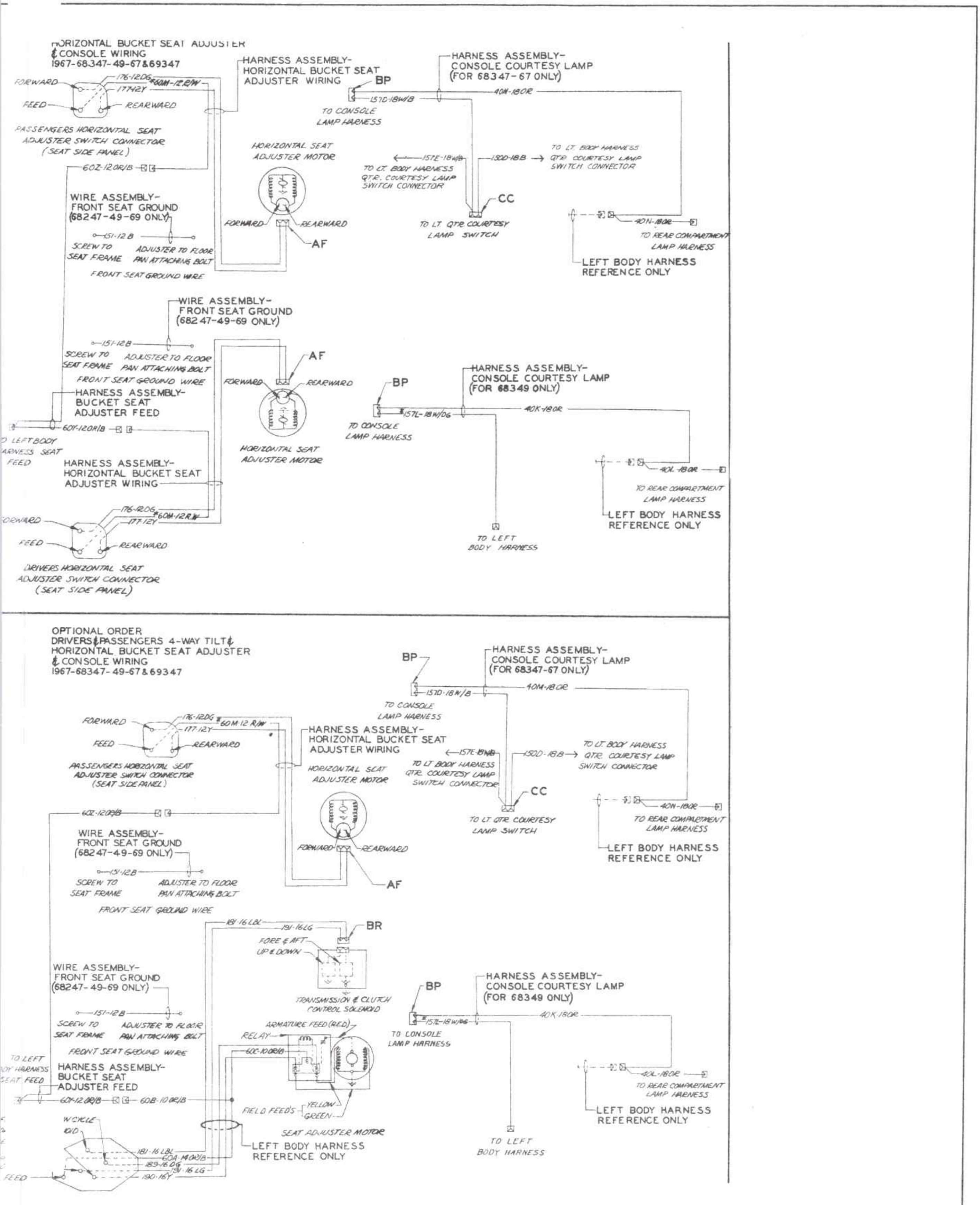
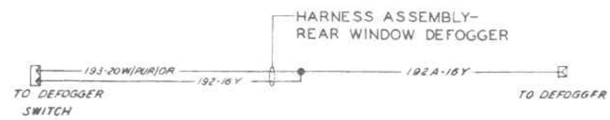
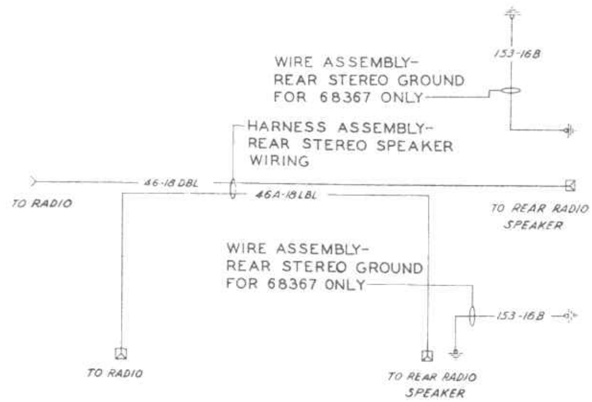


Fig. 12-68 Adjustable Seats and Seat Warmer Body Diagram

OPTIONAL ORDER
REAR WINDOW
DEFOGGER WIRING
1967-68069-68169
68247-49-69-68347-49-69



OPTIONAL ORDER
STEREO REAR RADIO
SPEAKER WIRING
1967- ALL CAD."C"



OPTIONAL ORDER
LEFT BODY HARNESS
BUCKET SEAT
1967-68349-69

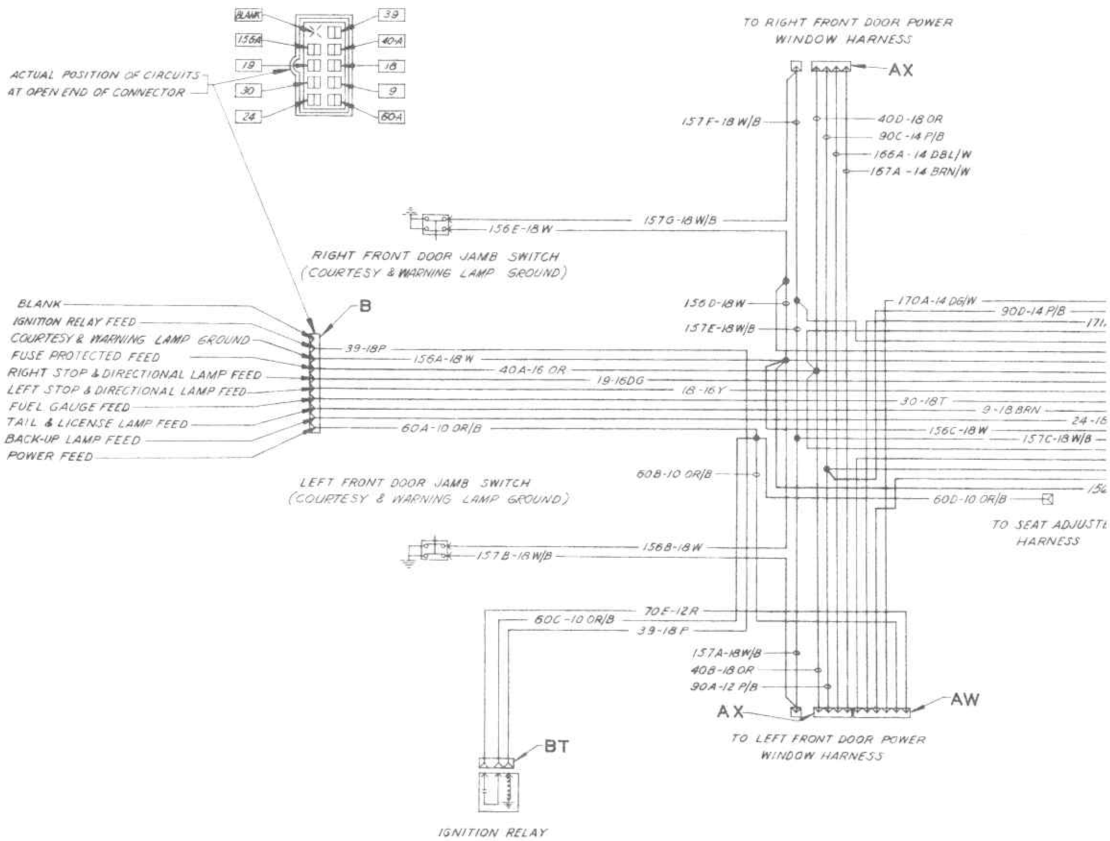
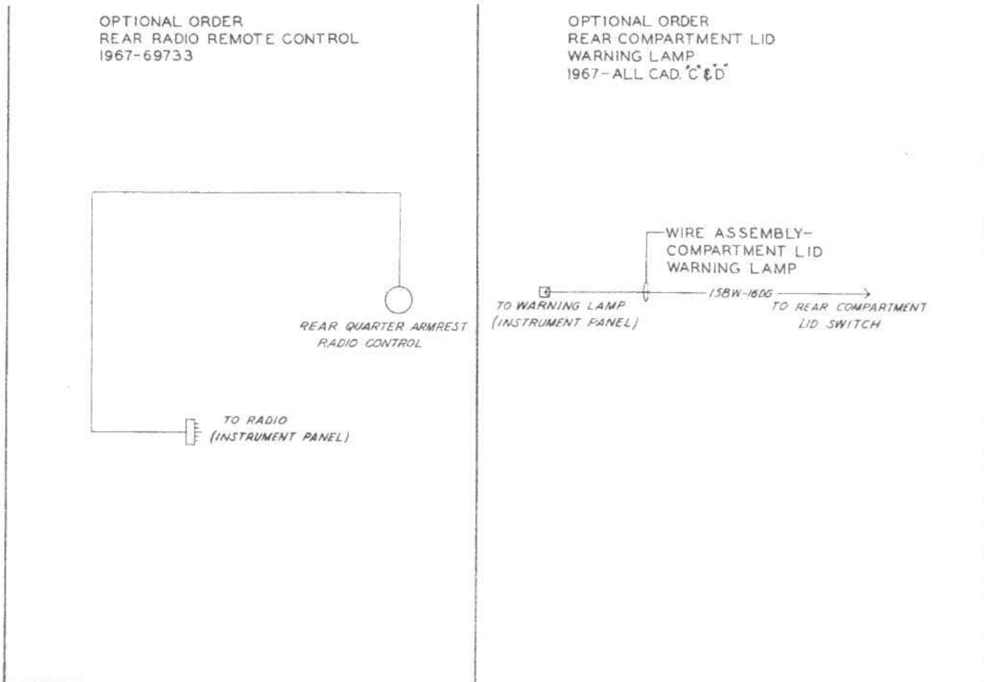


Fig. 12-69 Optional Body Wiring



WIRE IDENTIFICATION CHART

SYM.	COLOR	SYM.	COLOR
B	BLACK	P	PINK
BRN	BROWN	PUR	PURPLE
DBL	DARK BLUE	R	RED
DG	DARK GREEN	T	TAN
GY	GRAY	V	VIOLET
LBL	LIGHT BLUE	W	WHITE
LG	LIGHT GREEN	Y	YELLOW
OR	ORANGE		

WIRE GAUGE — CIRCUIT 90B - 18 — B / W — WIRE COLOR — STRIPE COLOR WHEN USED

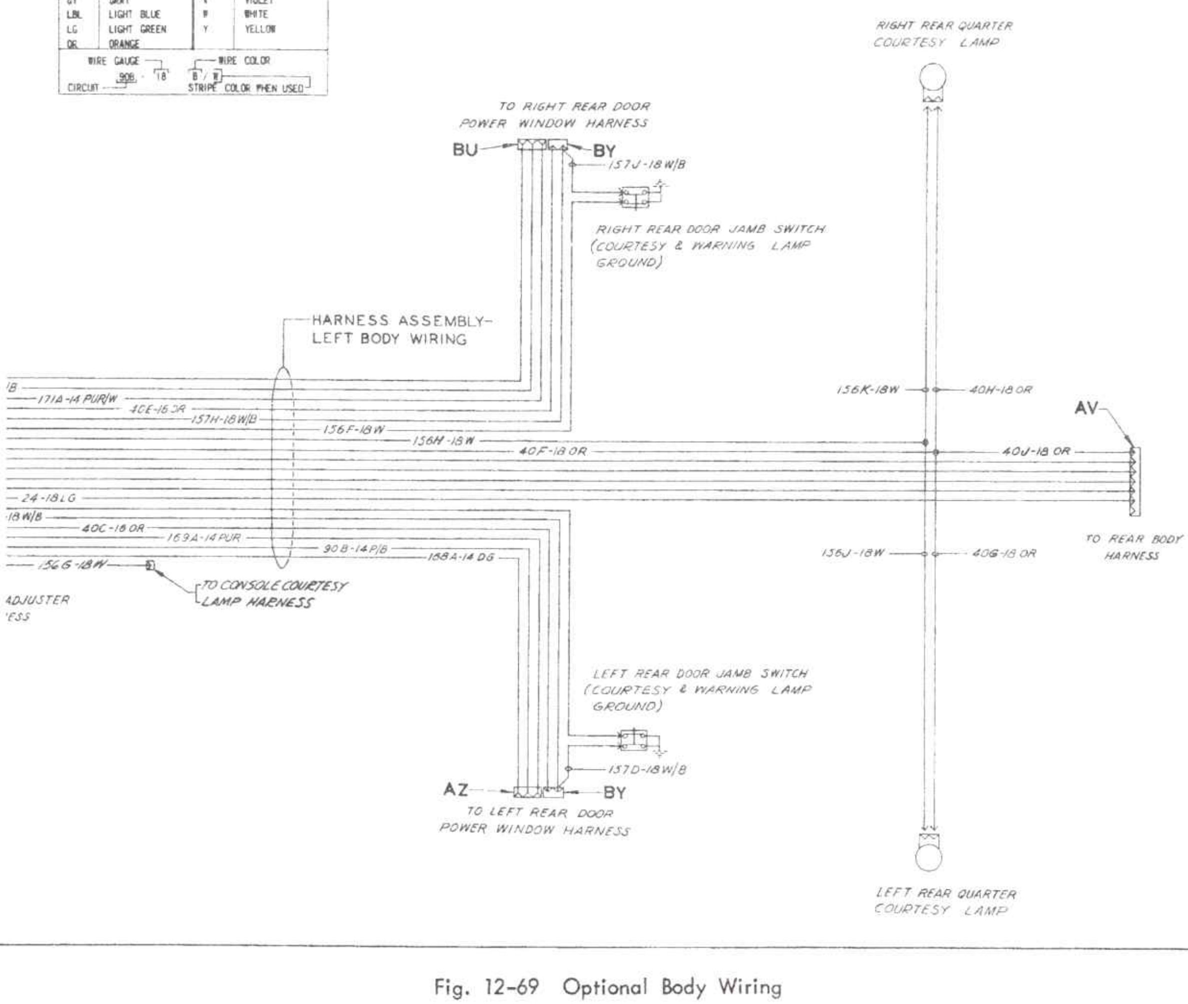


Fig. 12-69 Optional Body Wiring

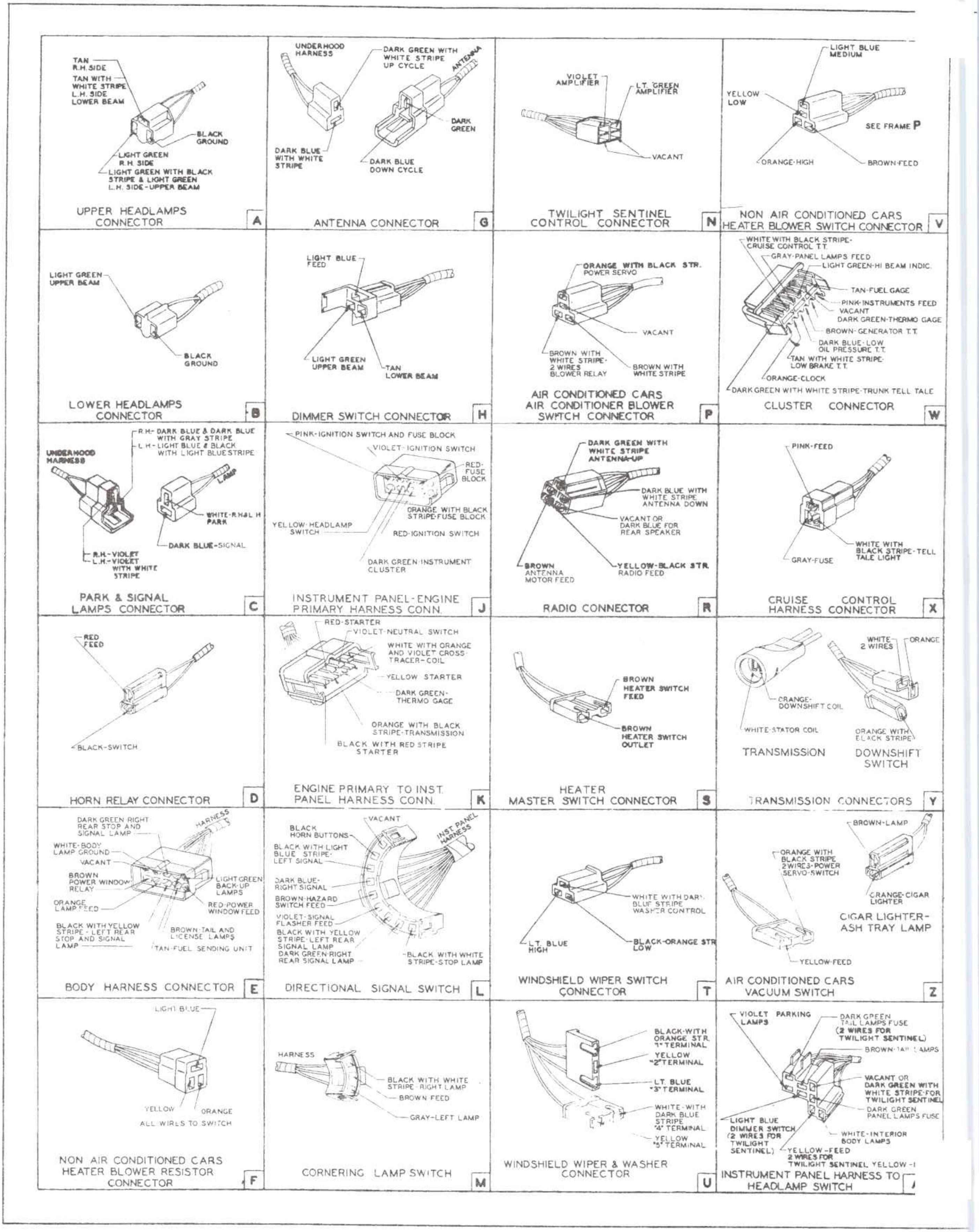


Fig. 12-70 Chassis Wiring Connectors - 680, 681, 682, 683, 697 Styles

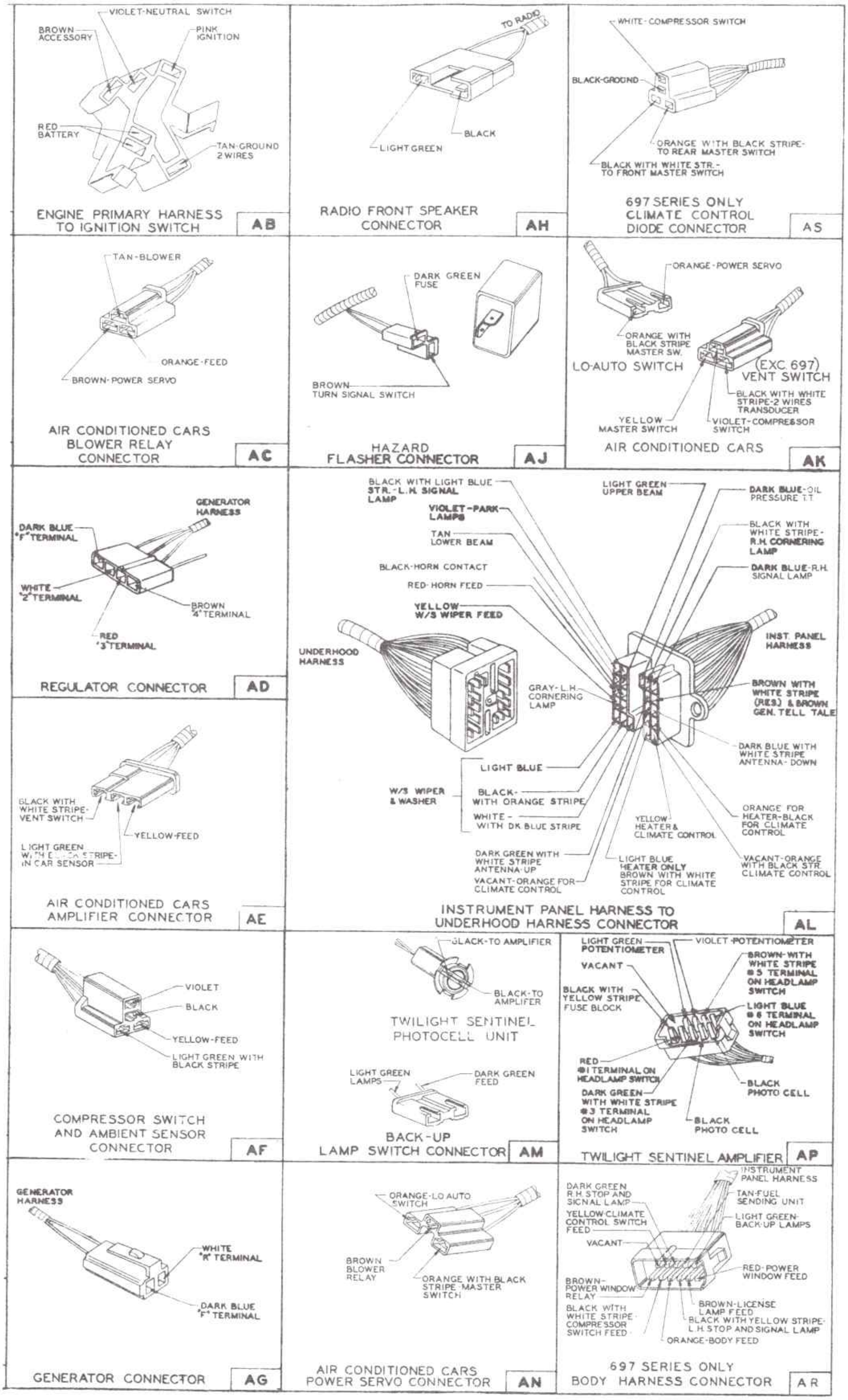


Fig. 12-70 Chassis Wiring Connectors - 680, 681, 682, 683, 697 Styles

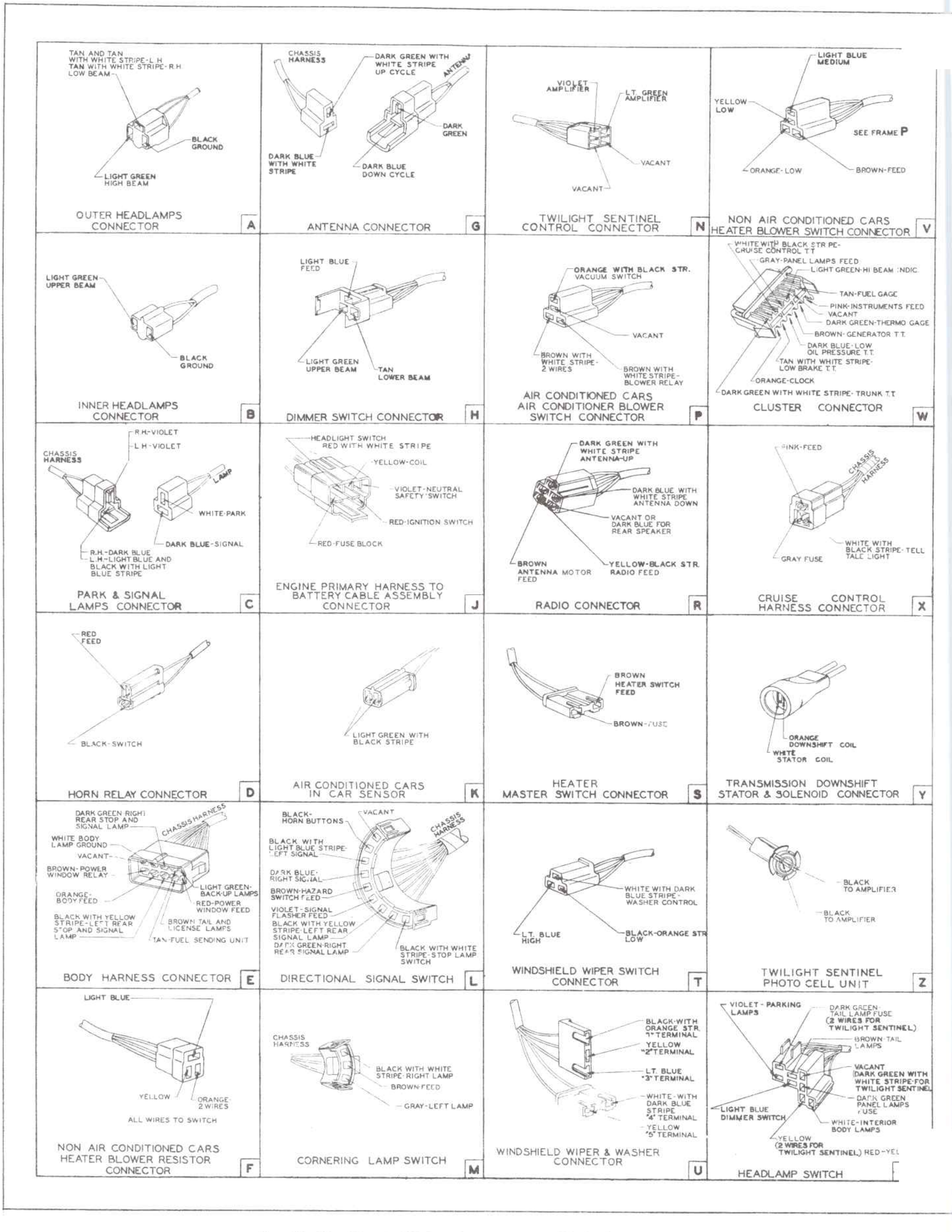


Fig. 12-71 Chassis Wiring Connectors - 693 Styles

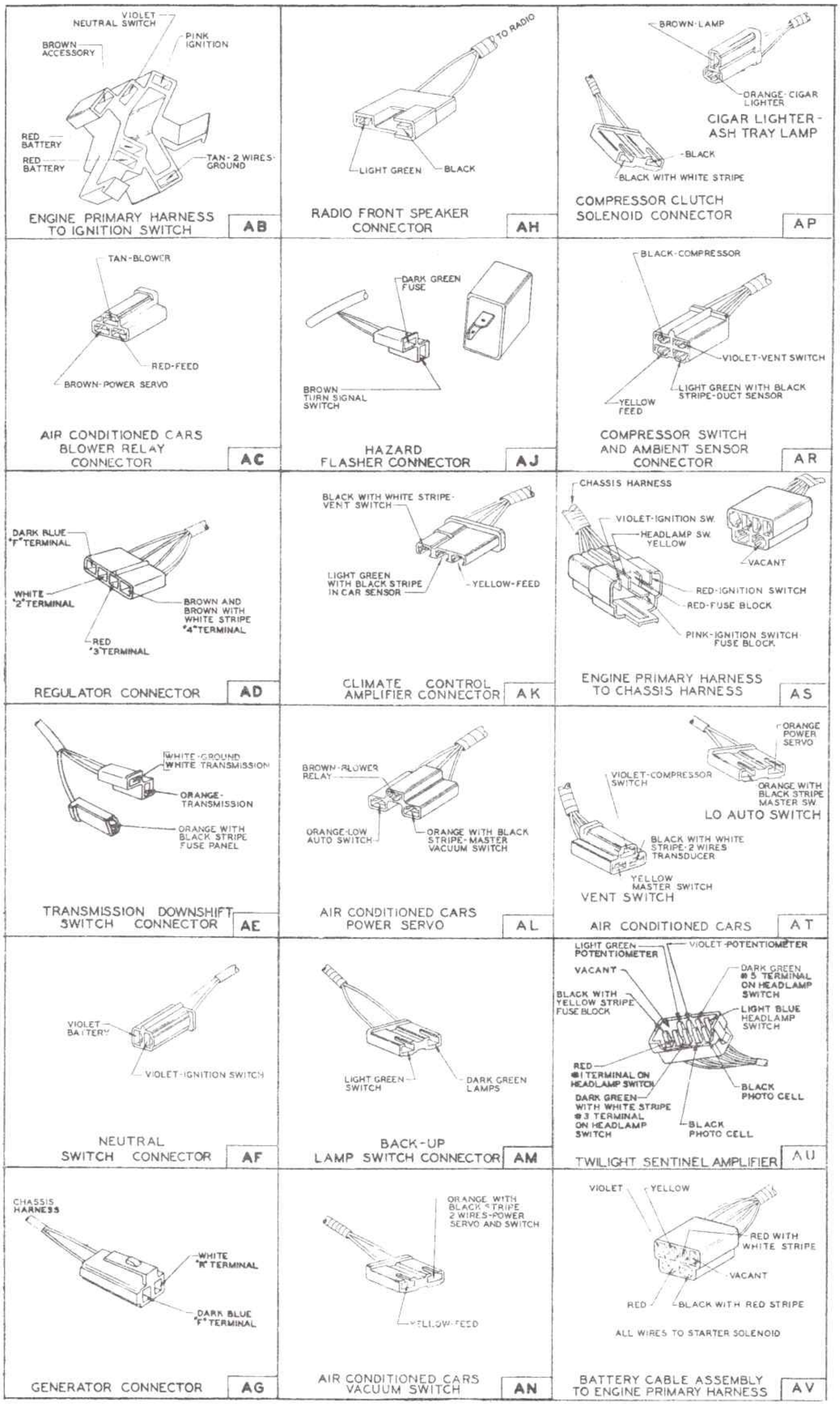


Fig. 12-71 Chassis Wiring Connectors - 693 Styles

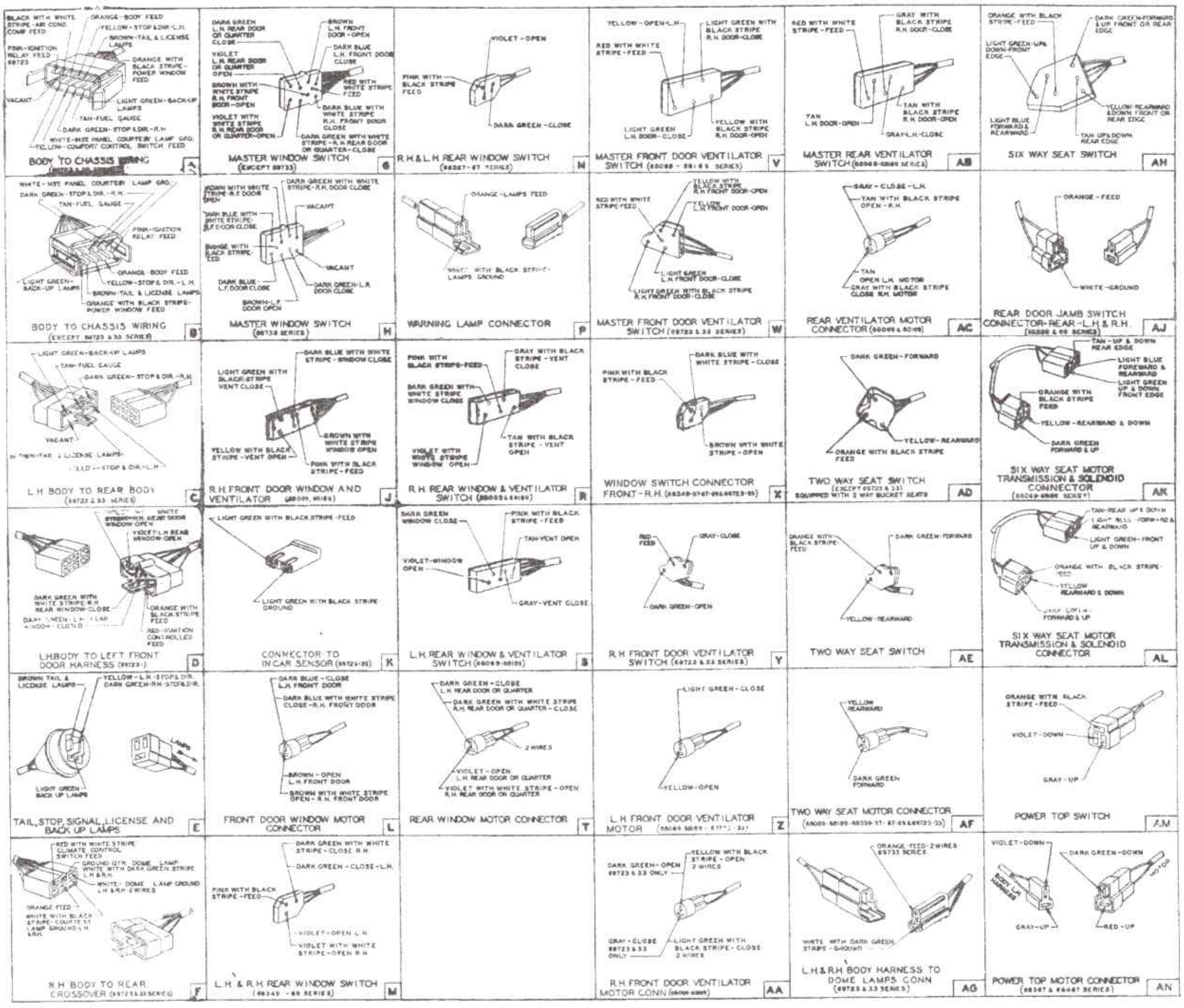


Fig. 12-72 Body Wiring Connectors

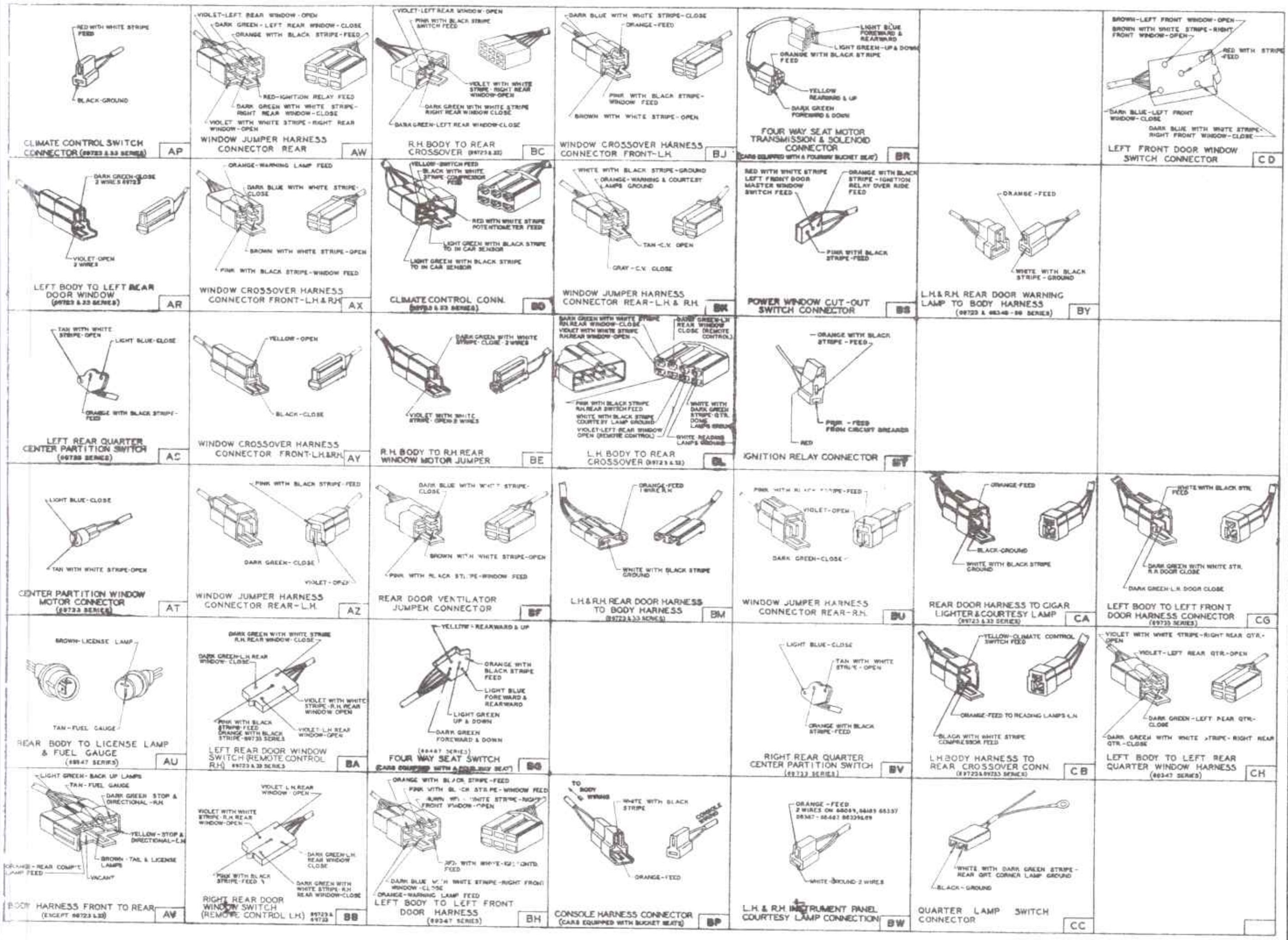


Fig. 12-72 Body Wiring Connectors

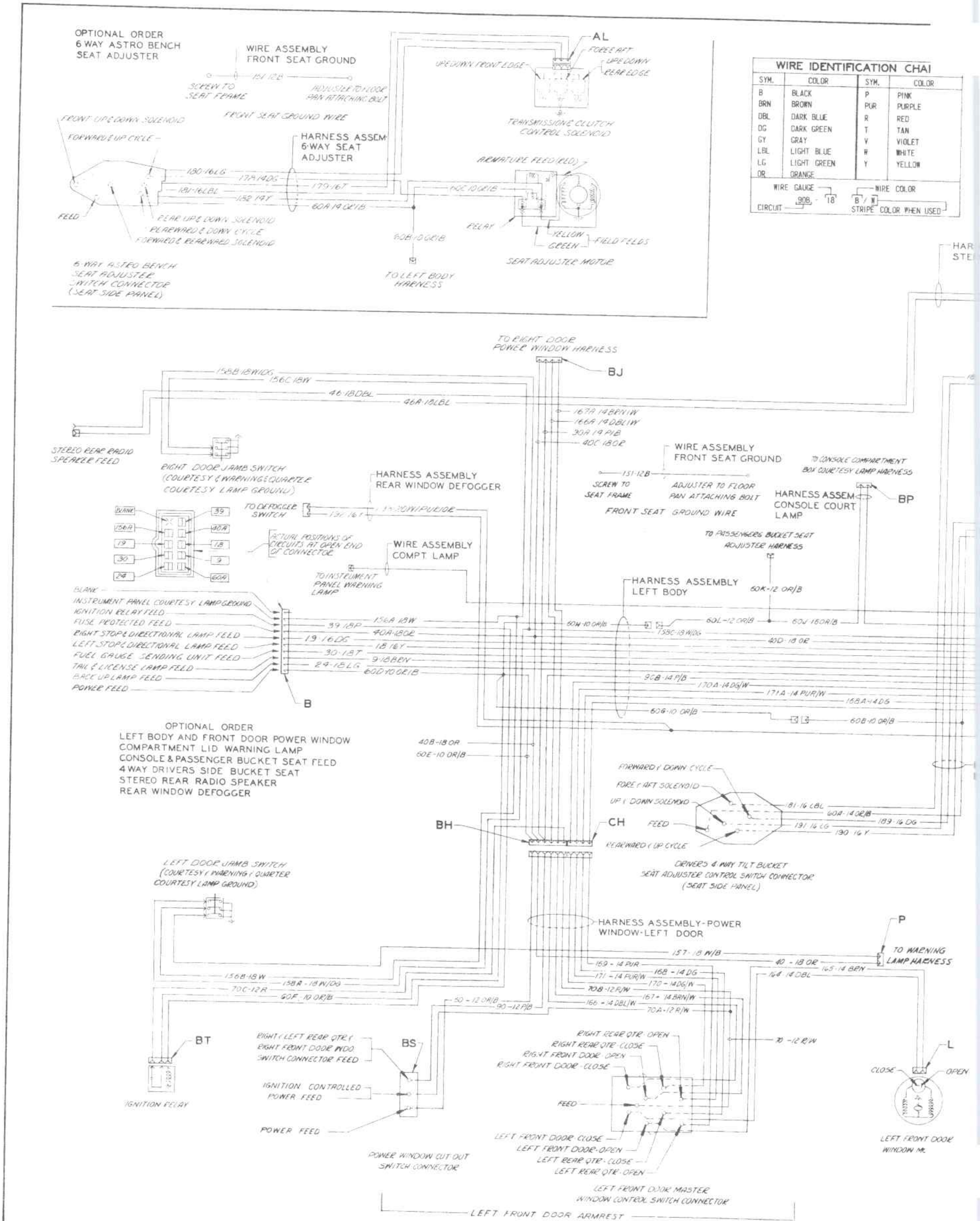


Fig. 12-73 Optional Body Wiring - 693 Style

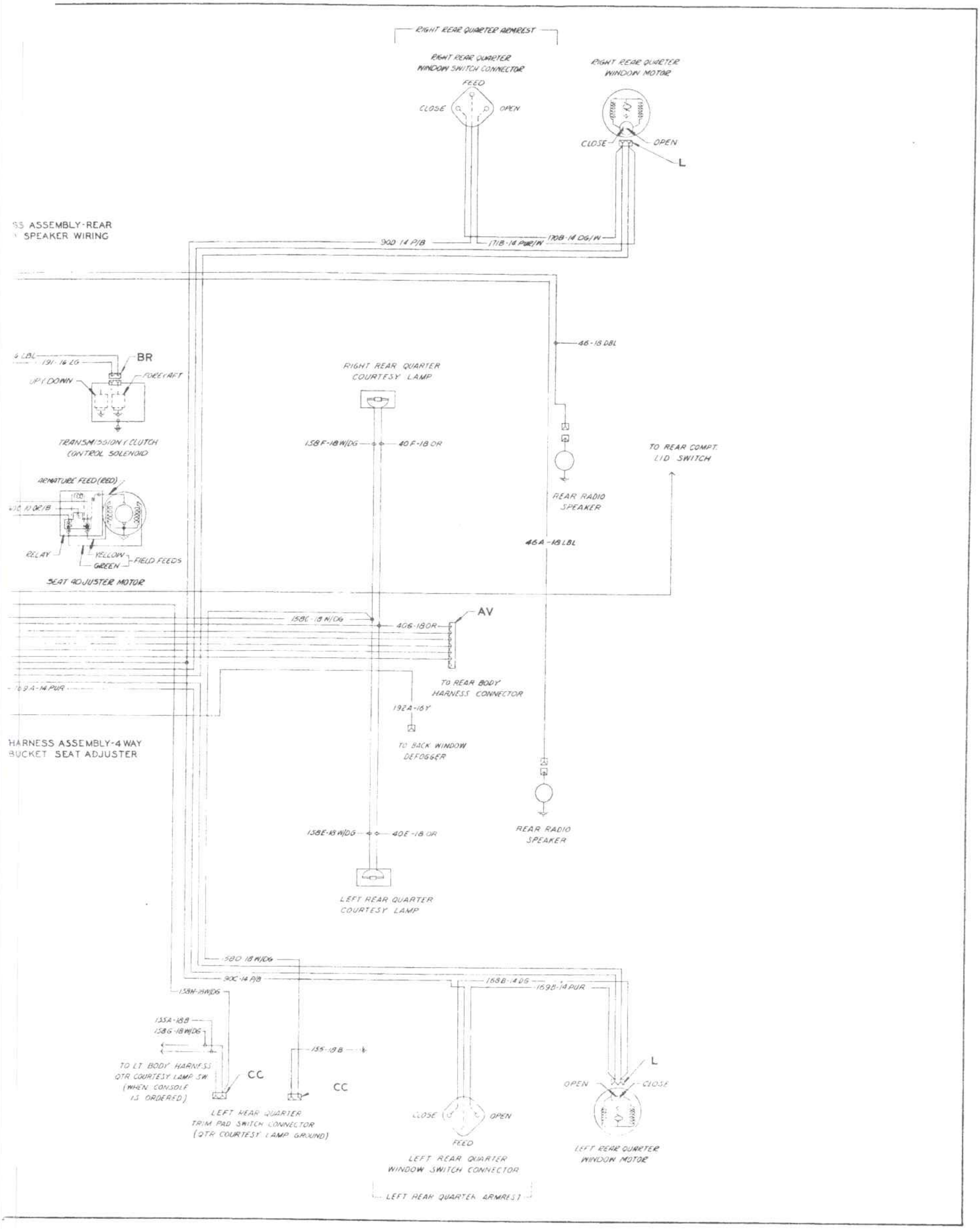


Fig. 12-73 Optional Body Wiring - 693 Style

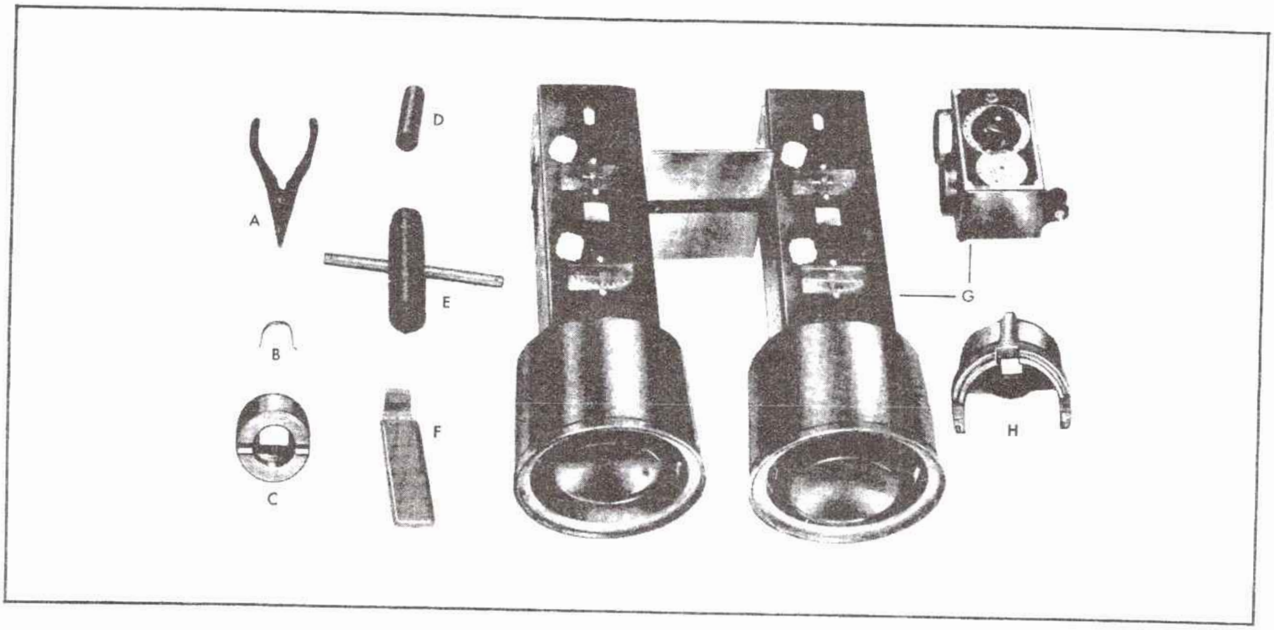


Fig. 12-74 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-4880	Snap Ring Pliers	E	J-6592-02	Windshield Wiper Transmission Spanner Wrench
B	J-7890	Brush Retainer Spring	F	J-8966	Windshield Wiper Arm Remover and Installer
C	J-22547	Ignition Switch Wrench	G	J-6663	Headlight Aimer Set
D	J-6968	Spanner Nut Wrench	H	J-21518-01	Float Tank Unit Wrench

GENERAL DESCRIPTION

Radiator

All 1967 Cadillac vehicles use an enclosed, 15 lb. pressure, low capacity radiator as part of the engine cooling system. The radiator filler neck, cap, and overflow tube are located on top of the right tank. The radiator is constructed with two vertical tanks that connect to the enclosed cross-flow tubing. The coolant enters the upper left hand inlet tank and circulates through the cross-flow tubes and enters the right return tank. Movement of the coolant in this manner provides efficient cooling and permits air to collect in the larger right tank under the radiator cap.

Grille

The 1967 Cadillac grille assembly (Fig. 13-1) consists of a pattern of horizontal and vertical fins with integral parking and turn signal light assemblies positioned in the grille extensions. A lower grille assembly (Fig. 14-1) is incorporated as an integral part of the front bumper assembly. Removal of the center grille assembly may be accomplished without removing the front bumper. However, the grille extensions must be removed prior to the center section, see Note 6.

To remove either lower grille section, the front bumper need not be removed.

SERVICE INFORMATION

1. Radiator Filler Cap Removal

The radiator cap on all 1967 Cadillac cars is of the bayonet type with a safety stop. If it is necessary to remove the cap when the system is at operating temperature, place a cloth over the cap and rotate it counterclockwise until the stop is reached. In this position the cooling system is vented to the atmosphere through the overflow hose. The cap should be left in this safety position until all steam pressure has been relieved.

The cap may then be removed by pressing down slightly and rotating cap further counterclockwise.

If the coolant boils when the cap is placed in the safety position and steam continues to escape, cool the radiator by flowing cold water over the outside while the engine is idling.

When installing the radiator cap, align the red paint stripe on the cap with the red paint stripe on the radiator cradle. In this position, the cap is on tightly and the radiator is pressurized.

2. Cooling System Preventive Maintenance

The cooling system should be drained, flushed with water only, and refilled every 24 months with water and an ethylene glycol base coolant to protect the engine to at least -20°F. Inhibitor and sealer should also be added to the system to retard rust and scale, keep water passages open, seal against internal leakage, and assist in lubricating the water pump.

Check all hose connections, and add inhibitor and sealer every 24 months, or whenever ethylene

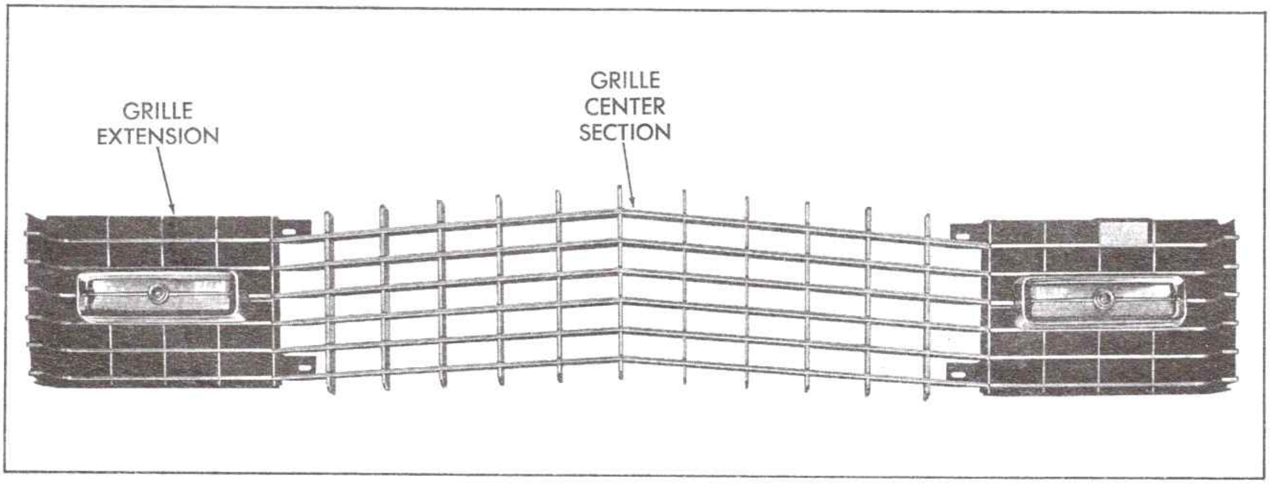


Fig. 13-1 Grille - Front View

glycol base coolant is changed. In addition, cooling system inhibitor and sealer should be added every fall after the car has been run 24,000 miles.

The above maintenance procedures are essential, regardless of the section of the country or the climate, to avoid the possibility of water pump corrosion, external leakage, or combustion gases blowing into the cooling system solutions leaking into the engine. If coolant solutions leak into the crankcase, sludge will form which will interfere with lubrication and, in some cases, may form varnish-like deposits that will cause gumming and eventual seizure of moving parts.

Check coolant level at each engine oil change to make certain proper level is maintained. Coolant level with engine cold, at room temperature, should be 3 inches below bottom of filler neck. Coolant level with engine hot, at normal operating temperature, should be 1 inch below bottom of filler neck. Do not overfill. Proper levels are shown on label below radiator filler cap.

3. Testing Coolant Solution

A hydrometer test will indicate whether ethylene glycol or water, or both, should be added to maintain the desired freezing point of the solution.

Some devices used for testing solutions will indicate the correct freezing point only when tested at a specific temperature. Other testers, provided with thermometers and tables, indicate freezing points corresponding to readings made at various temperatures. Disregarding the temperature of the solution when testing may cause an error as large as 30°F. in determining the freezing point.

4. Radiator and Cap Leak Check

The cooling system pressure should be checked whenever cases of overheating, coolant loss, or coolant odors are reported. Any one of the common types of cooling system testers will prove helpful in testing the cooling system according to the following procedure:

a. Testing Radiator Cap

CAUTION: Avoid removing the radiator cap while the engine is at normal operating temperature, as hot coolant will spray out. If it is necessary to remove the cap while the engine is hot, rotate the cap slowly counterclockwise until the first stop is reached, and allow pressure to escape. Then turn it further counterclockwise to remove.

1. Remove radiator cap.

2. Wet cap gasket with water and wash away sediment, if any, then install cap on tester.

3. Build up pressure to cap capacity. The tester should read between 13-1/2 and 16-1/2 psi.

4. The cap should hold the pressure within these limits for approximately 10 seconds. A cap that does not meet these requirements should be replaced.

b. Testing Cooling System

1. Tighten all hose connections.

2. Fill radiator to normal level.

3. Install tester in radiator neck, following instructions supplied with tester.

4. Build pressure up to 20 psi.

5. The cooling system should hold this pressure for approximately two (2) minutes. A pressure drop will indicate a leak.

5. Radiator Assembly— Removal and Installation

a. Removal (Fig. 13-2)

1. Disconnect negative battery cable.

2. Open drain cock at bottom left corner of radiator. Remove radiator cap so coolant will flow freely.

NOTE: To save coolant, remove radiator filler overflow hose and connect to radiator drain cock.

3. On cars equipped with air conditioner, disconnect compressor as described in Section 1, Note 31a.

Do not disconnect hoses or lines. Position compressor to one side.

4. On cars equipped with air conditioner, remove plastic clip that holds high pressure vapor line to top of cradle. Position vapor line to one side.

5. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator inlet and outlet pipes.

6. Loosen clamp and disconnect heater return hose at right radiator tank.

7. Disconnect two transmission cooler lines at transmission fluid cooler tank on right side of radiator. Plug all openings to prevent loss of fluid.

8. Remove two top radiator cradle clamps.

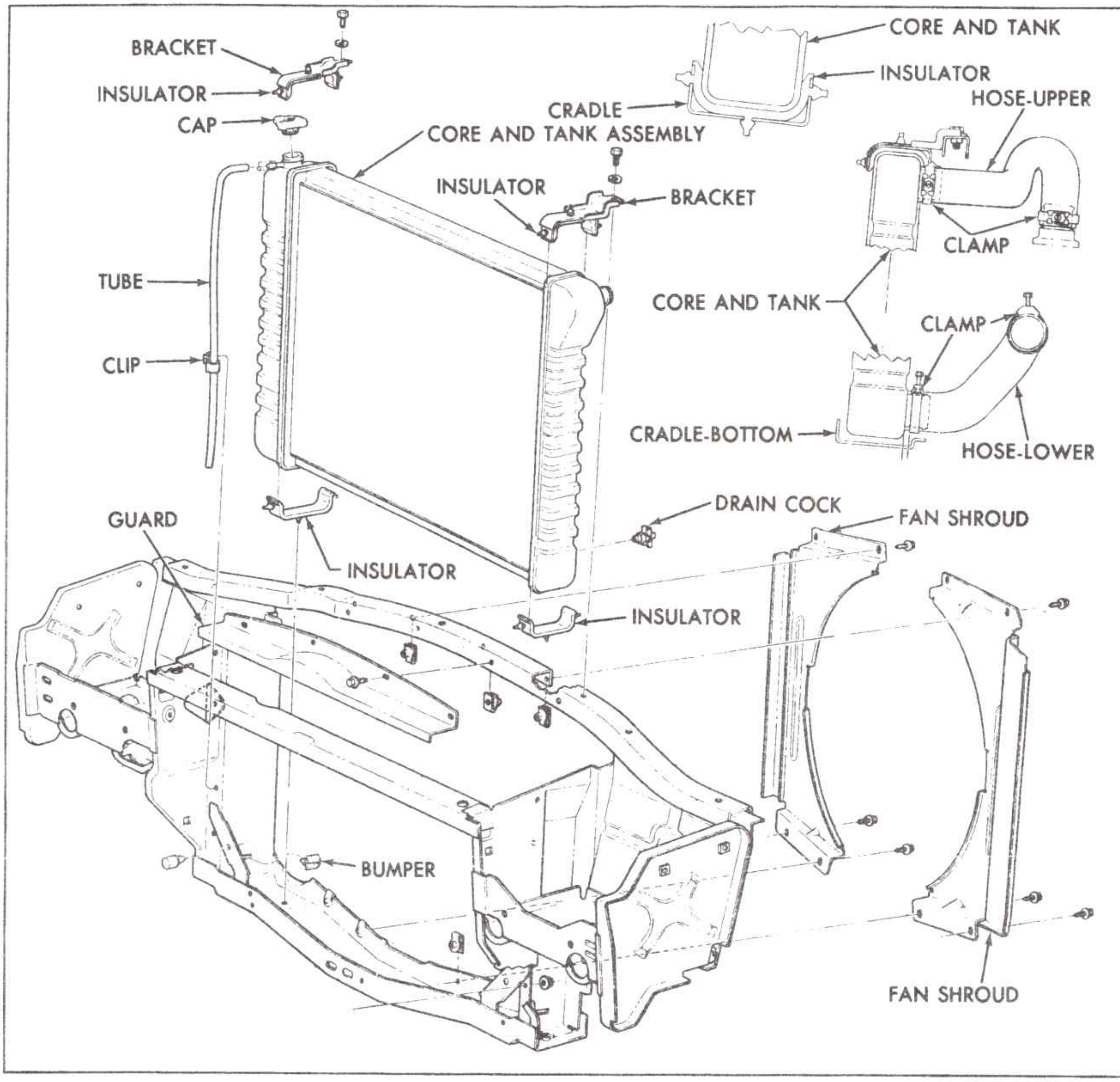


Fig. 13-2 Radiator and Cradle Assy.

9. Remove four screws that hold finger guard to cradle and remove guard.

10. If vehicle is so equipped, remove three vacuum hoses to vacuum distributor switch on side of left hand radiator tank. Mark each hose so that it can be installed in the correct position.

11. Being careful not to damage radiator on fan, remove radiator by lifting straight up.

b. Installation (Fig. 13-2)

1. Carefully lower radiator into position in cradle.

2. Install finger guard and secure with four screws. Tighten screws to 10 foot-pounds.

3. Install two top radiator cradle clamps and secure with two screws. Tighten screws to 10 foot-pounds.

4. Connect two transmission cooler lines at transmission fluid cooler tank on right side of radiator.

5. Connect upper and lower radiator hoses at radiator and secure with two hose clamps.

6. Connect heater return hose to right radiator tank.

7. On cars equipped with air conditioner, install compressor as described in Section 1, Note 31b.

8. If vehicle is so equipped, note marks and install vacuum hoses to vacuum distributor switch on side of left hand radiator tank.

9. On cars equipped with air conditioner, position high pressure vapor line on top of cradle, and secure with plastic clip.

10. Close radiator drain cock.

11. Fill cooling system with recommended coolant, also add rust inhibitor and sealer.

12. Connect negative battery cable.

13. Run engine sufficiently to pump coolant through entire system and check radiator and transmission for fluid levels.

14. Check all connections for leaks.

6. Upper Grille Assembly— Removal and Installation

a. Removal (Fig. 13-3)

1. Remove two bolts with nuts from upper grille support and remove support.

2. Remove two screws securing lower grille support and remove support.

3. Remove splash shield from both wheel housings for access to attaching screw and remove screw securing grille extension to radiator cradle.

4. Disconnect parking lights at connector.

5. Remove two screws at each end of grille center section that secure grille assembly to radiator cradle.

6. Remove four nuts holding center section retainer plate at grille extension.

7. Loosen one nut securing angle bracket to radiator cradle and position bracket 180° away for clearance.

8. Repeat step 7 for opposite side.

9. Remove either right or left grille extension.

10. Remove grille center section.

11. Remove remaining grille extension.

b. Installation (Fig. 13-3)

1. Install either left or right grille extension in position.

2. Install grille center section in position.

3. Install remaining grille extension in position.

4. Swivel left angle bracket back into position and secure with one nut.

5. Repeat step 4 for right side.

6. Loosely install four nuts holding center section at grille extensions.

7. Loosely install two screws at each end of center section holding grille assembly to radiator cradle.

8. Align grille assembly and tighten screws and nuts installed in steps 6 and 7.

9. Connect parking lights at connector.

10. Install one screw at each side holding grille extension to radiator cradle inside wheel housing. Install rubber splash shield.

11. Install lower grille support and secure with two screws.

12. Install upper grille support and secure with two bolts with nuts.

7. Grille Extension— Removal and Installation

a. Removal (Fig. 13-3)

1. To service grille extension, remove one bolt and flat washer securing lower portion of front fender inner panel mud deflector to bumper lower outer end.

2. Reposition lower half of mud deflector and remove grille extension retaining screw at bumper upper end.

3. Remove parking and turn signal light assembly as described in Section 12, Note 6a.

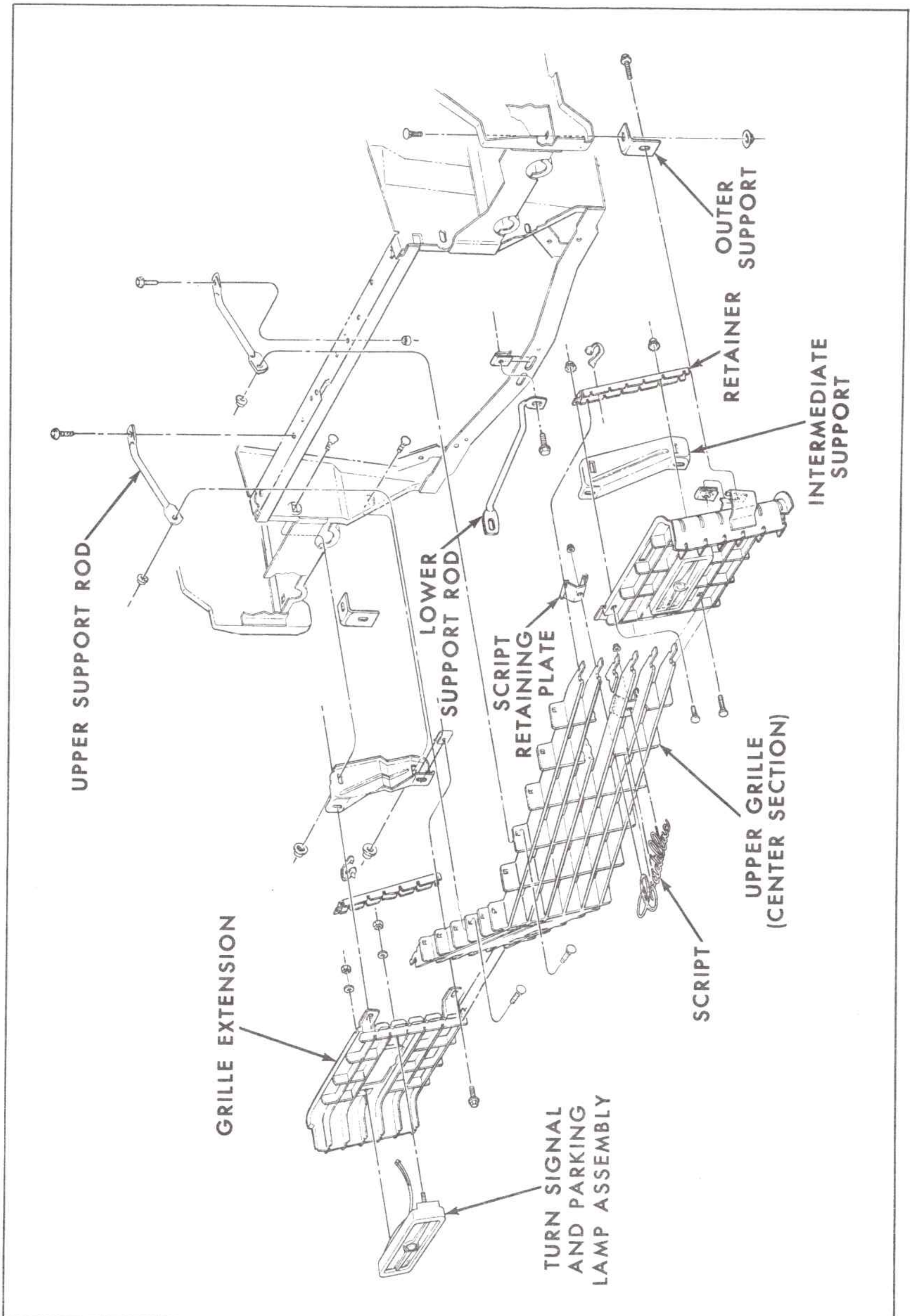


Fig. 13-3 Grille Disassembled

4. Remove two bolts with nuts from upper grille center section support and remove support.

5. Remove two screws securing lower grille center section support and remove support.

6. Remove two screws at each end of grille center section securing grille assembly to radiator cradle.

7. Remove two nuts holding center section retainer plate to grille extension at side being removed.

8. Loosen one nut securing angle bracket to radiator cradle and position bracket 180° away for clearance.

9. Remove grille extension.

b. Installation (Fig. 13-3)

1. Install grille extension in position.

2. Swivel angle bracket back into position and secure with one nut.

3. Loosely install four nuts holding center section at grille extension.

4. Loosely install two screws at each end of center section holding grille assembly to radiator cradle.

5. Align grille assembly and tighten screws and nuts installed in steps 3 and 4.

6. Install parking lights as described in Section 12, Note 6b.

7. Install one screw holding grille extension to radiator cradle inside wheel housing. Install rubber splash shield.

8. Install lower grille support and secure with two screws.

9. Install upper grille support and secure with two bolts with nuts.

8. Lower Grille Assembly—Removal and Installation

a. Removal (Fig. 14-1)

1. Remove screw and nut that secures grille to strap.

2. Loosen two bolts securing right hand grille assembly to front bumper and slide grille half out of bumper.

3. Repeat steps 1 and 2 for left side.

b. Installation

1. Install right hand portion of lower grille in position under retaining bolts in bumper. Do not tighten bolts.

2. Repeat step 1 for left hand grille section.

3. Align lower grille and tighten four attaching bolts.

4. Install grille straps and secure with screws and nuts.

SPECIFICATIONS
(Except 693)

RADIATOR	
Capacity of System (with Heater)	18.00 qts.
Capacity of System (with Air Conditioner)	19.00 qts.
Capacity of System (without Heater and Air Conditioner)	16.00 qts.
Capacity of System (Seventy-Five Series)	20.00 qts.
Area of Core	480 sq. in.
Core Depth	
Non-Air Conditioned Car	1.26 in.
Air Conditioned Cars	1.98 in.
Core Center Constant	
Non-Air Conditioned Cars	.25 in.
Air Conditioned Cars	.16 in.
Tubing Spacing	.55 in.
Radiator Cap Pressure	13.5 to 16.5 psi

TORQUE SPECIFICATIONS

Material Number	Application	Size	Torque
Steel	Transmission Oil Cooler Line to Radiator Tank	5/8-18	28 ft. lbs.
1010	Fan Shroud to Radiator Support Bracket Screw	1/4-20	10 ft. lbs.
1010	Radiator Hose Clamps	12-24	26 in. lbs.

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.

RADIATOR AND GRILLE

The service information that follows pertains only to the Fleetwood Eldorado. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as given in the first part of this section.

Radiator

The radiator used in the Eldorado is the same as the radiator used in the standard car which utilizes the cross-flow principle, Fig. 13-5. All recommendations and cautions applied to the standard car radiator should be exercised when servicing the Eldorado radiator.

Grille

The 1967 Fleetwood Eldorado grille consists of a pattern of vertical and horizontal bars with a projecting center section. The outer grille ends also serve as headlamp covers and rotate down behind the bumper when the headlights are operated, Fig. 13-4. A lower grille section is also used, Fig. 14-6.

9. Radiator Assembly—Removal and Installation

a. Removal (Fig. 13-5)

1. Disconnect negative battery cable.

2. Open drain cock at bottom left corner of radiator. Remove radiator cap so coolant will flow freely.

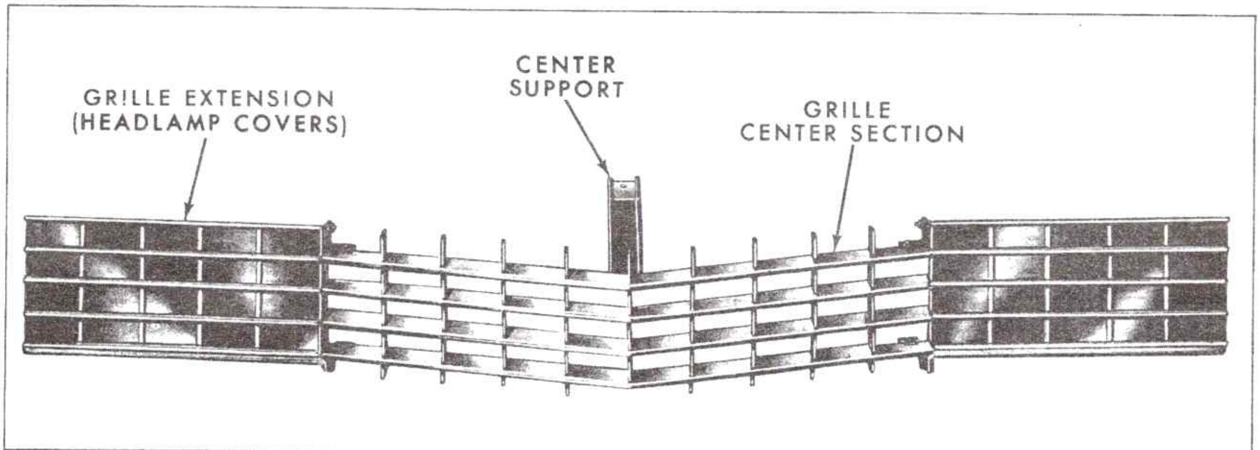


Fig. 13-4 Grille - Front View

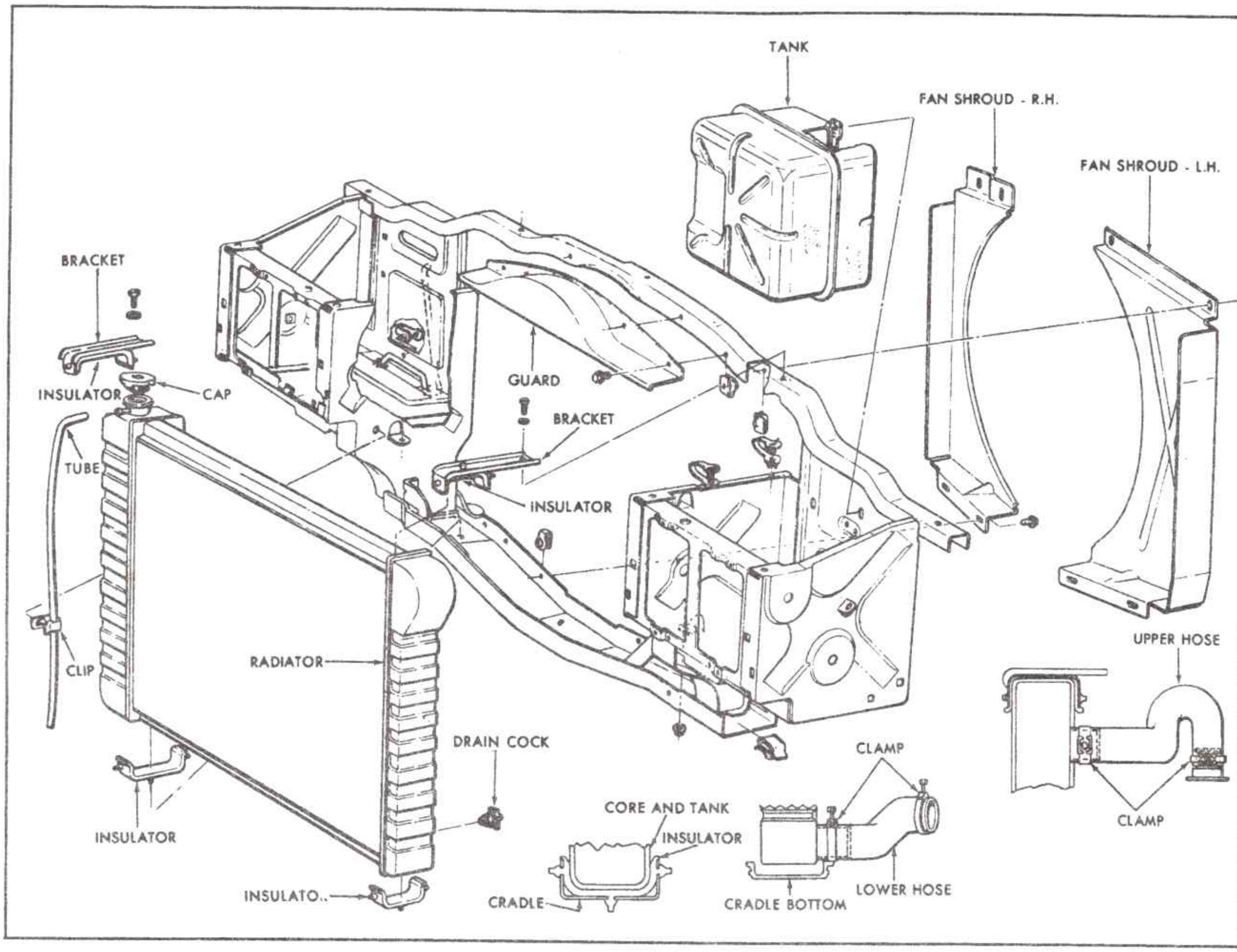


Fig. 13-5 Radiator and Cradle Assy.

NOTE: To save coolant, remove radiator filler overflow hose and connect to radiator drain cock.

3. On cars equipped with air conditioner, disconnect compressor as described in Section I, Note 91a.

Do not disconnect hoses or lines. Position compressor to one side.

4. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator inlet and outlet pipes.

5. Loosen clamp and disconnect heater return hose at right radiator tank.

6. Disconnect two transmission cooler lines at transmission fluid cooler tank on right side of radiator. Plug all openings to prevent loss of fluid.

7. Remove two top radiator cradle clamps.

8. Remove three screws that hold finger guard to cradle and remove guard.

9. If vehicle is so equipped, remove three vacuum hoses from vacuum distributor switch on side of left hand radiator tank. Mark each hose so that it may be installed in the correct position.

10. Being careful not to damage radiator on fan, remove radiator by lifting straight up.

b. Installation (Fig. 13-5)

1. Carefully lower radiator into position in cradle.

2. Install finger guard and secure with three screws. Tighten screws to 10 foot-pounds.

3. Install two top radiator cradle clamps and secure with two screws. Tighten screws to 10 foot-pounds.

4. Connect two transmission cooler lines at transmission fluid cooler tank on right side of radiator.

5. Connect upper and lower radiator hoses at radiator and secure with two hose clamps.

6. Connect heater return hose to right radiator tank.

7. On cars equipped with air conditioner, install compressor as described in Section 1, Note 91b.

8. If vehicle is so equipped, note marks and install vacuum hoses to vacuum distributor switch on side of left hand radiator tank.

9. Close radiator drain cock.

10. Fill cooling system with recommended coolant, also add rust inhibitor and sealer.

11. Connect negative battery cable.

12. Run engine sufficiently to pump coolant through entire system and check radiator and transmission fluid levels.

13. Check all connections for leaks.

10. Grille Center Section— Removal and Installation

a. Removal (Fig. 13-6)

1. Remove two screws securing grille mounting brackets to radiator cradle at right side of grille.

2. Repeat step 1 for the left side.

3. Loosen two screws holding lower support brackets to grille assembly and swivel brackets 90° out of way.

4. Remove two bolts and nuts securing grille center support and remove center support.

5. Remove grille assembly.

b. Installation (Fig. 13-6)

1. Position grille assembly to radiator cradle.

2. Swivel lower support brackets into position and secure with two screws. Tighten bracket to grille screws.

3. Install upper attaching screws.

4. Install grille center support and secure with two bolts and nuts.

11. Grille Extension (Headlamp Cover)— Removal and Installation

a. Removal (Fig. 11-11)

1. Rotate headlamp cover to the down position.

2. Remove four attaching nuts from back of assembly.

3. Remove cover assembly from swivel links.

b. Installation (Fig. 11-11)

1. Position cover assembly on swivel links.

2. Loosely install four nuts securing headlamp cover to swivel links.

3. Rotate headlamp covers to the up position. Align headlamp covers and tighten attaching nuts.

12. Lower Grille Assembly— Removal and Installation

a. Removal (Fig. 14-6)

1. Remove front bumper as described in Section 14, Note 13a.

2. Remove screw with washer and bolt with nut and washers securing center support to bumper.

3. Remove four bolts and nuts from each side of grille that secure angle brackets to grille and bumper.

4. Remove grille from bumper.

b. Installation

1. Position grille section into bumper.

2. Loosely install four bolts and nuts on each side to secure angle brackets to bumper and grille section.

3. Align grille and tighten attaching bolts.

4. Install center support and secure with one screw with washer and one bolt with nut and washer.

5. Install front bumper as described in Section 14, Note 13b.

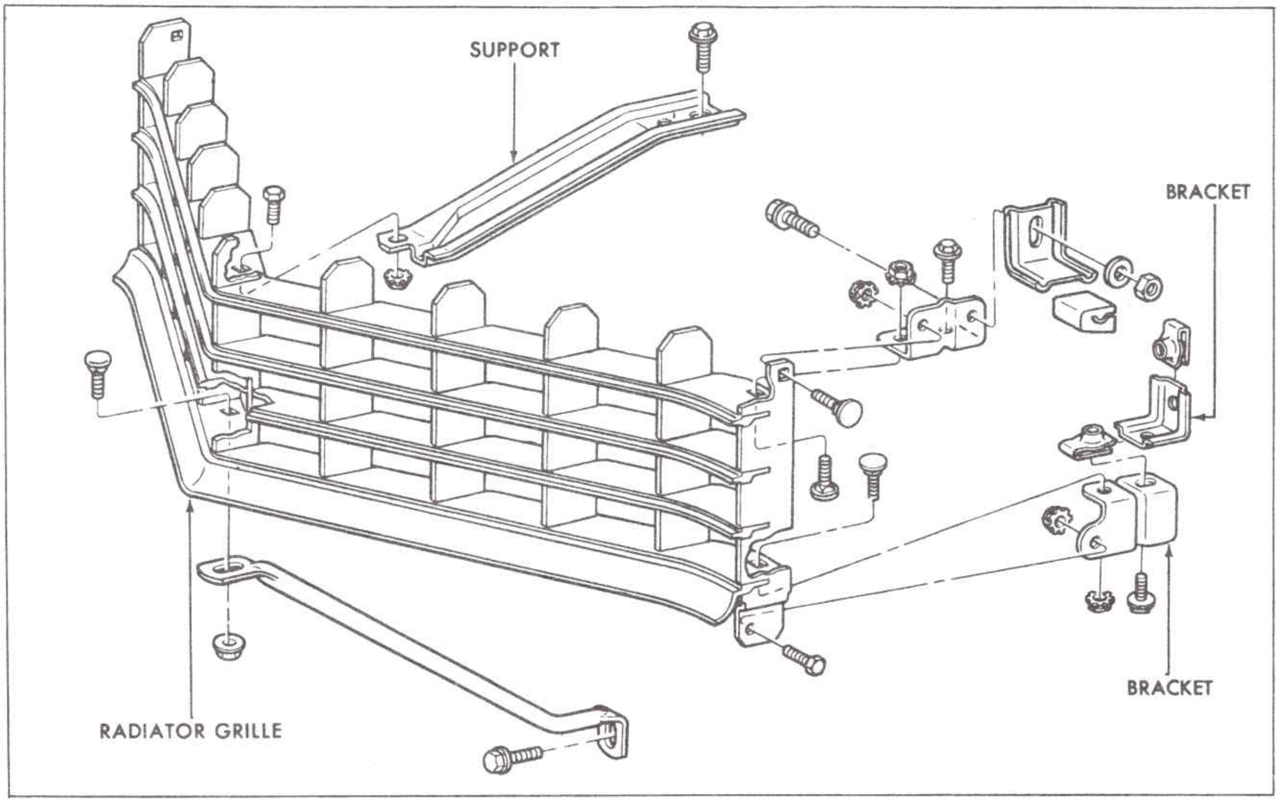


Fig. 13-6 Grille - Disassembled

SPECIFICATIONS

RADIATOR	
Capacity of System (with Heater)	17.00 Qts.
Capacity of System (with Air Conditioner)	17.50 Qts.
Capacity of System (without Heater and Air Conditioner)	16.00 Qts.
Area of Core	480 Sq. In.
Core Depth	
Non-Air Conditioned Car	1.26 In.
Air Conditioned Cars	1.98 In.
Core Center Constant	
Non-Air Conditioned Cars	.20 In.
Air Conditioned Cars	.16 In.
Tubing Spacing	.55 In.
Radiator Cap Pressure	13.5 to 16.5 psi

TORQUE SPECIFICATIONS (693 Only)

Material Number	Application	Size	Torque
Steel	Transmission Oil Cooler Line to Radiator Tank	5/8-18	28 ft. lbs.
1010	Fan Shroud to Radiator Support Bracket Screw	1/4-20	10 ft. lbs.
1010	Radiator Hose Clamps	12-24	26 in. lbs.

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.

GENERAL DESCRIPTION

The front bumper assembly is of a six-piece design that includes a bold center face section with attached right and left upper and lower ends and integral lower grille, Fig. 14-1.

The rear bumper assembly consists of eight major sections that are bolted together; the fuel filler door, which also serves as the license holder, right and left filler panels, license guard escutcheon, right and left outer ends, center section and a painted lower panel, Fig. 14-3.

SERVICE INFORMATION

1. Front Bumper Assembly Removal and Installation

a. Removal (Fig. 14-1)

1. Raise front end of car and support with jackstands.

2. Remove headlight assembly as follows:

a. Remove three screws holding headlight bezel to fender and remove bezel.

b. Remove four screws securing headlight assembly to fender.

c. Disconnect headlight leads and remove headlight assembly.

3. Reaching through headlight opening, remove nut and flat washer securing bumper restrictor to lower portion of fender.

4. Repeat Steps 2 and 3 for opposite side of car.

5. Remove eight screws securing air deflector to underbody and remove air deflector.

6. Remove four bolts with nuts and flat washers securing inner mounting bars to frame.

7. Remove two screws with washers from the jacking restrictors, one on each side.

8. Support bumper with jacks or blocks and remove four bolts with nuts and flat washers securing outer mounting bars to frame. It will be necessary to remove one spring nut and one screw securing splash shield to wheelhousing for access to these bolts.

9. With the aid of a helper, remove bumper assembly from car.

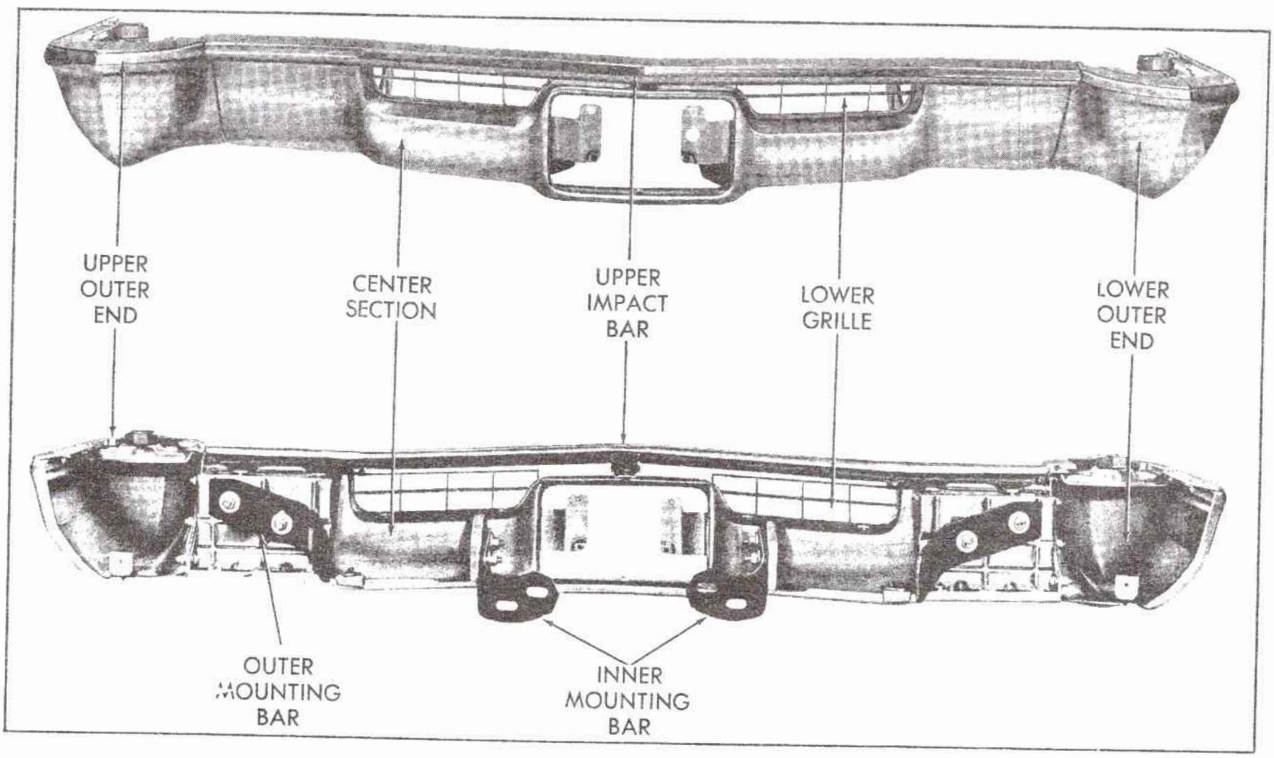


Fig. 14-1 Front Bumper - Front and Rear View

b. Installation (Fig. 14-1)

1. With the aid of a helper, position bumper assembly on car and support with jacks or blocks.

2. Loosely install eight bolts, nuts, and washers securing mounting bars to frame.

3. Align bumper assembly as follows:

a. Horizontal alignment is obtained by means of the slots located at the inner mounting bars to frame bolts and the outer mounting bars to center bar bolts.

b. Vertical alignment is obtained by means of the slots located at the inner mounting bars to frame bolts.

c. Fore and aft alignment is obtained by means of the slots located at the inner mounting bars to center bar bolts and the outer mounting bar to frame bolts.

4. After alignment has been obtained, tighten mounting bar bolts to 50 foot-pounds.

5. Install two screws with washers securing jacking restrictors, one on each side.

6. Install air deflector and secure with eight screws.

7. Secure splash shields to wheelhousing with one fastener and one screw.

8. Install one nut with flat washer on each bumper restrictor and tighten.

9. Install headlight assemblies as follows:

a. Connect headlight leads and position headlight assembly in fender.

b. Secure headlight assembly with four screws.

c. Position headlight bezel to fender and secure with three screws.

10. Remove jacks or blocks used to support bumper and lower car.

2. Front Bumper Outer End—Removal and Installation—Right or Left

a. Removal (Fig. 14-2)

1. Remove front bumper as described in Note 1a.

2. Remove four bolts with lock washers and flat washers securing outer end to center section.

3. Remove reinforcement plate and outer end.

4. Remove cover plate as described in Note 2a.

b. Installation (Fig. 14-2)

1. Install cover plate as described in Note 2b.

2. Position outer end to center section with reinforcement plate and secure with four bolts with lock washers and flat washers.

3. Install front bumper as described in Note 1b.

3. Front Bumper Cover Plate—Removal and Installation—Right or Left

a. Removal (Fig. 14-2)

1. Remove front bumper as described in Note 1a.

2. Remove two bolts with lock washers and flat washers and three screws securing cover plate to outer end.

b. Installation (Fig. 14-2)

1. Position cover plate on outer end, align and secure with two bolts with lock washers and flat washers and three screws.

2. Install front bumper as described in Note 1b.

4. Front Bumper Upper Impact Bar—Removal and Installation

a. Removal (Fig. 14-2)

1. Remove front bumper as described in Note 1a.

2. Remove both outer ends as described in Note 2a.

3. Remove four bolts with lock washers and flat washers and one screw securing upper impact bar to center section.

4. Remove two bolts with lock washers and flat washers that hold each lower grille section to upper impact bar.

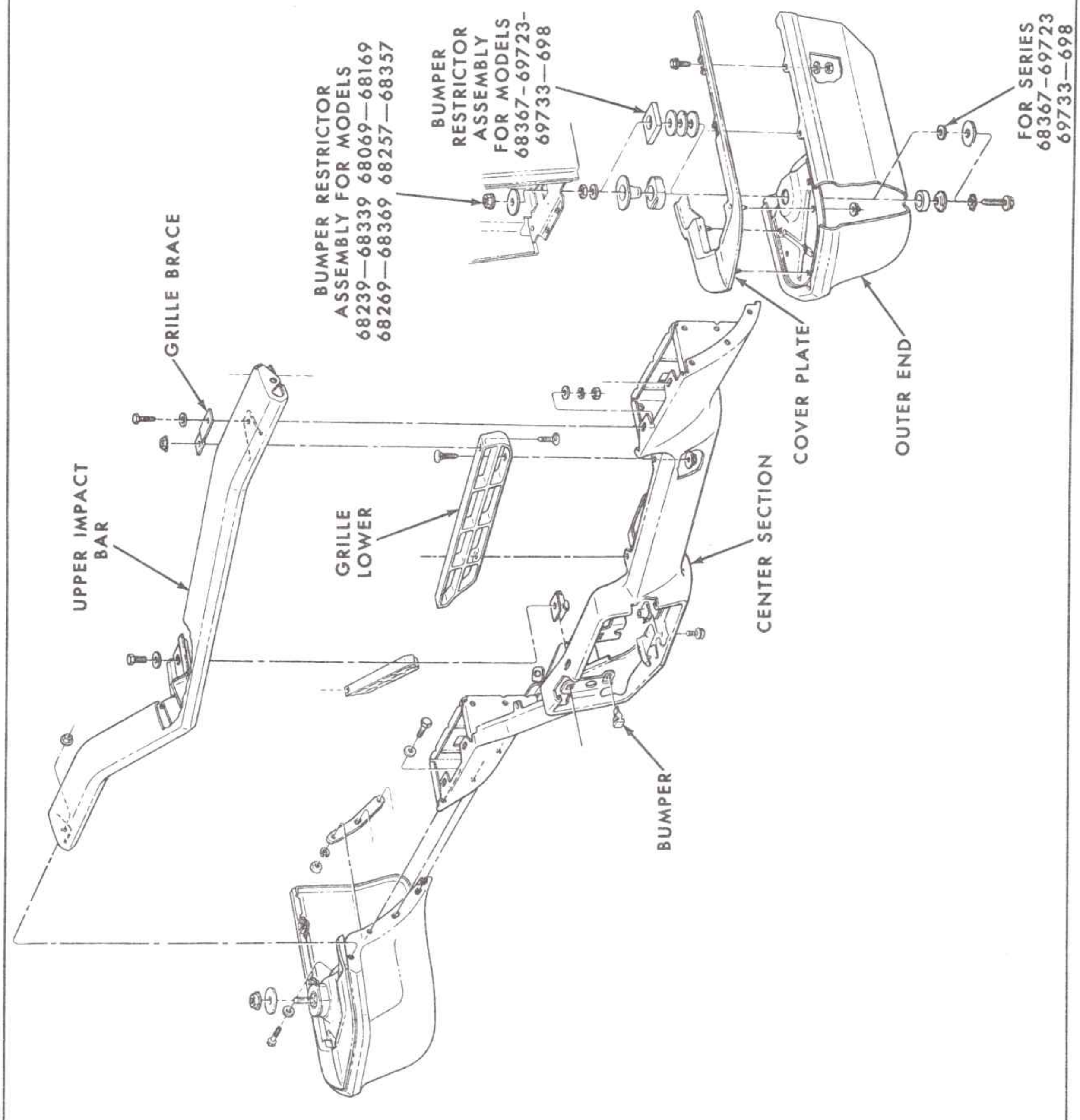


Fig. 14-2 Front Bumper - Disassembled

b. Installation (Fig. 14-2)

1. Position upper impact bar on center section and loosely install four bolts with nuts and washers and one screw.

2. Install both outer ends as described in Note 2b. However, do not tighten bolts yet.

3. Install two bolts holding lower grille sections to upper impact bar.

4. Align bumper and tighten all bolts.

5. Install front bumper as described in Note 1b.

5. Front Bumper Center Section—Removal and Installation

a. Disassembly (Fig. 14-2)

1. Remove front bumper as described in Note 1a.

2. Remove both outer ends as described in Note 2a.

3. Remove upper impact bar as described in Note 4a.

4. Remove lower grille as described in Section 13, Note 13a.

b. Assembly (Fig. 14-2)

1. Install lower grille in bumper as described in Section 13, Note 13b.

2. Install upper impact bar and outer ends as described in Note 4b.

3. Install front bumper assembly as described in Note 1b.

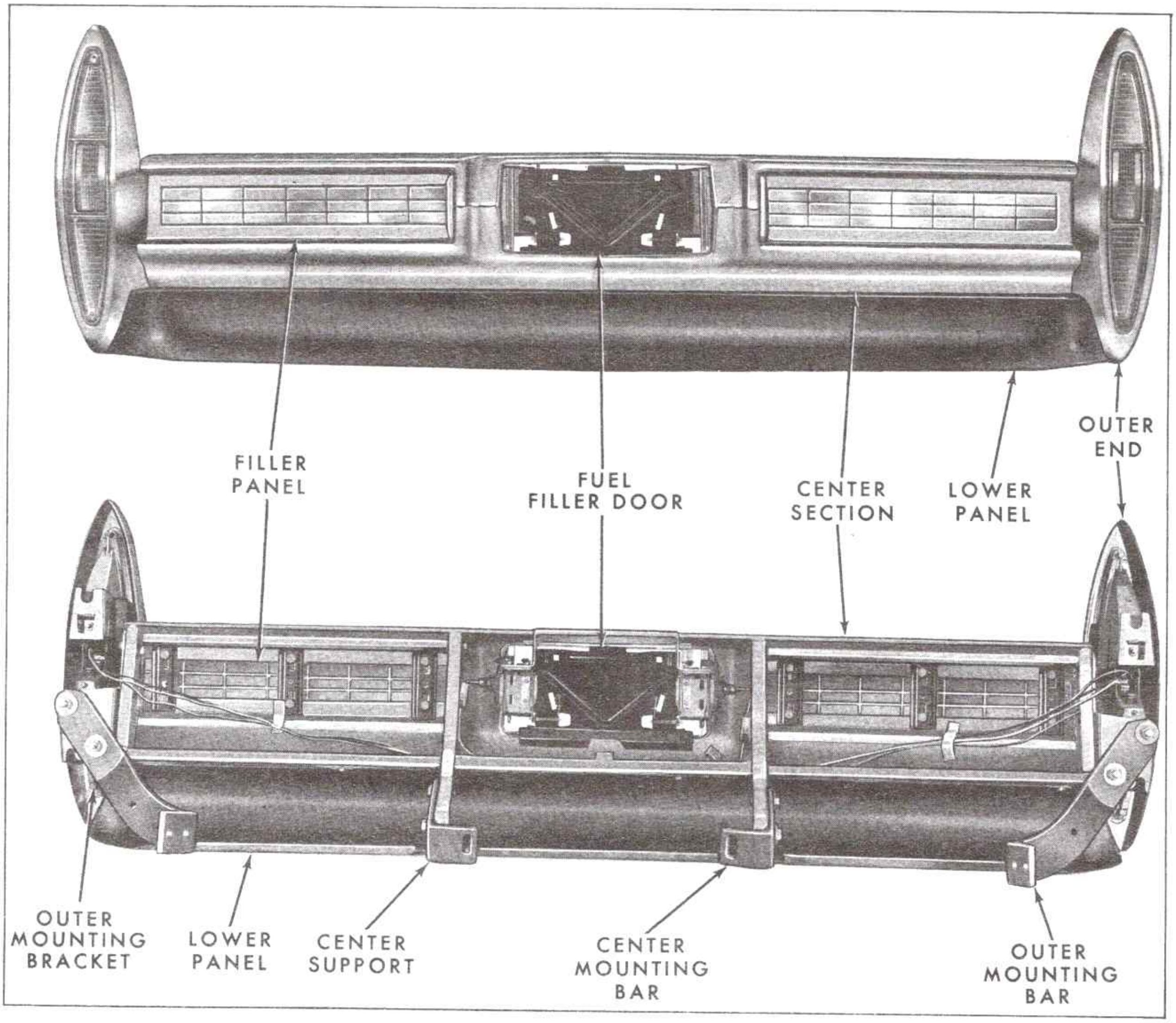


Fig. 14-3 Rear Bumper - Front and Rear View

6. Rear Bumper Assembly—Removal and Installation

a. Removal (Fig. 14-3)

1. Open rear compartment lid.

2. Working through access holes in rear of side trim assemblies of luggage compartment, remove two nuts and flat washers, one each side, securing upper bumper end and rubber cushion assembly to body.

3. Unplug two rear light connectors, one on each side near center of rear end panel.

4. Support bumper assembly with jacks or blocks. Cover surface of jack or blocks that contact bumper to prevent scratching or marring painted lower portion of rear bumper.

NOTE: Mark frame at bumper mounting brackets to assist in alignment when installing bumper.

5. Remove six bumper mounting bar to frame nuts, flat washers and bolts, two on each outer mounting bar to frame, and one on each inner mounting bar to frame.

6. With the aid of a helper, remove bumper assembly with mounting bars attached.

b. Installation (Fig. 14-3)

1. With the aid of a helper, position bumper assembly on car and support with jacks or blocks. Make certain that all electrical wiring is correctly routed and not pinched and that rubber mud shields are properly tucked in at each outer end bar at body.

2. Loosely install six bolts, flat washers, and nuts, two on each outer mounting bar, one on each inner mounting bar, securing bumper mounting bars to frame.

3. An overall alignment of rear bumper assembly is obtained by using any one or all of the following adjustment combinations, (Figs. 14-3 and 14-4).

a. Horizontal alignment is obtained by means of the slots located at the inner mounting bars to frame bolts and the outer mounting bars to bumper bolts.

b. Vertical alignment is obtained by means of the slots located at the inner mounting bars to bumper bolts and the outer mounting bars to frame bolts.

c. Fore and aft alignment is obtained by means of the slots located at the inner mounting bars to bumper bolts and the outer mounting bars to frame bolts.

4. After obtaining alignment, tighten mounting bar bolts to 50 foot-pounds.

5. From inside rear compartment, install two flat washers and nuts, one on each side, securing rubber cushion assembly to body at outer end bar and tighten until uniform gap is secured between outer end bar and quarter panel.

6. Remove jack or blocks used to support bumper assembly.

7. Connect rear light connectors to plug sockets on each side near center of rear end panel.

7. Rear Bumper Outer End—Right or Left—Removal and Installation

a. Removal (Fig. 14-4)

1. Remove rear bumper assembly as described in Note 6a.

2. Lay bumper assembly face down on a covered surface with a block supporting center section at end being removed.

3. Lift off rubber cushion and bolt assembly from upper end bracket.

4. Remove mud shield and two nuts, flat washers and bolts holding outer mounting bar to lower bracket of outer end.

5. Remove three nuts, lock washers, flat washers, bolts, reinforcing plate and spacer securing outer end to center section.

6. Remove two nuts with lock washers holding tail light assembly to outer end and remove tail light assembly.

b. Installation (Fig. 14-4)

1. Position tail light assembly inside outer end and secure assembly with two nuts with lock washers.

2. Position outer end to center section and loosely install three bolts, flat washers, lock washers, reinforcement plate spacer and nuts.

3. Align end to center section and lower panel, and tighten securing bolts to 50 foot pounds.

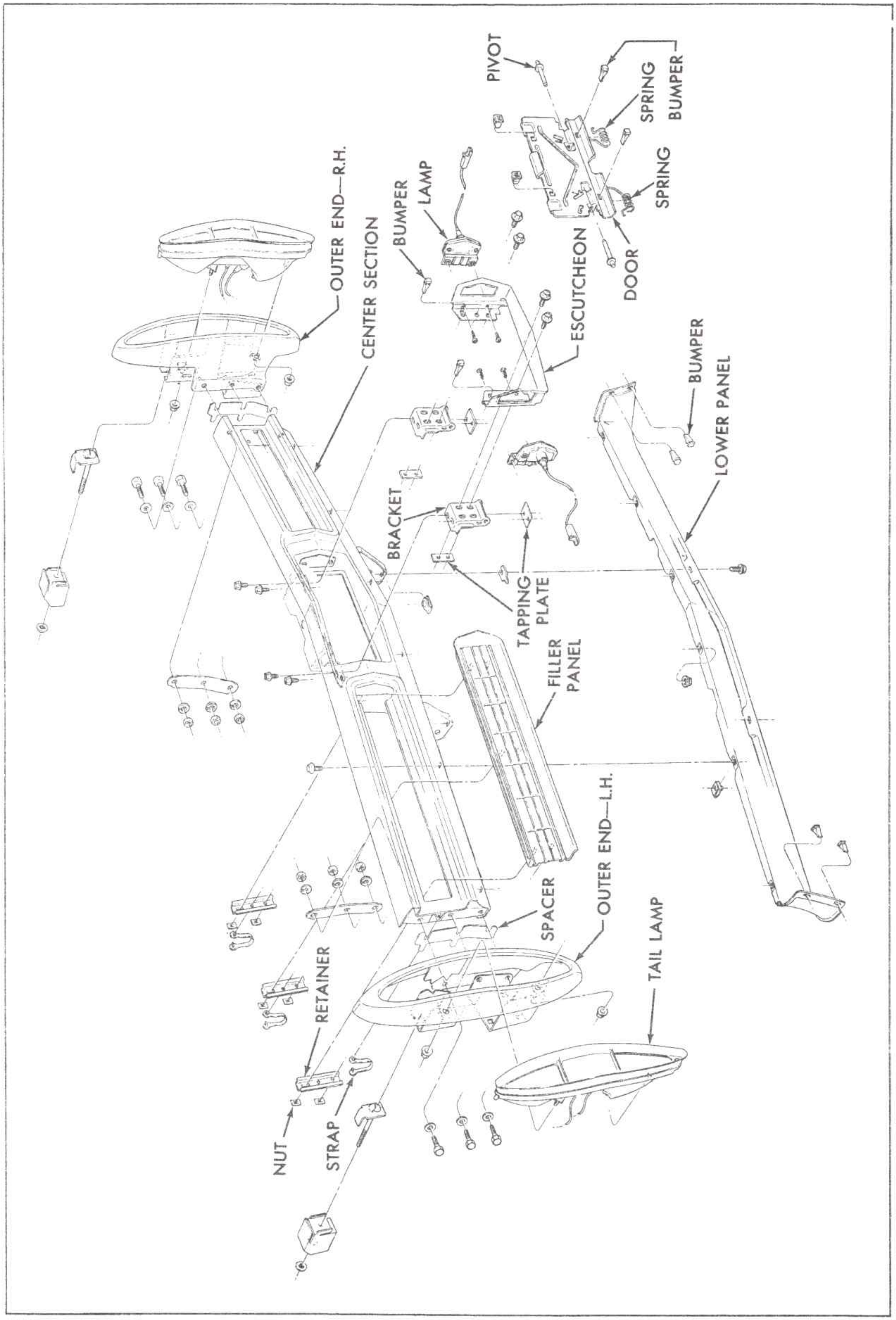


Fig. 14-4 Rear Bumper - Disassembled

8. Rear Bumper Center Section— Removal and Installation

a. Removal (Fig. 14-4)

1. Remove rear bumper assembly as described in Note 6a.

2. Remove both outer ends as described in Note 7a.

3. Remove lower panel by removing two screws and shims at inner mounting bar and six screws from upper edge of panel at bumper.

4. Remove center section filler panels as described in Note 10a.

5. Remove license guard escutcheon as described in Note 11a.

6. Remove fuel tank filler door as described in Note 12a.

b. Installation (Fig. 14-4)

1. Install fuel tank filler door as described in Note 12b.

2. Install license guard escutcheon as described in Note 11b.

3. Install center section filler panels as described in Note 10b.

4. Install lower panel and secure with two screws and shims at inner mounting bar and at upper edge of panel at bumper.

5. Install both outer ends as described in Note 7b.

6. Install rear bumper assembly as described in Note 6b.

9. Rear Bumper Lower Panel— Removal and Installation

a. Removal (Fig. 14-4)

1. Remove rear bumper assembly as described in Note 6a.

2. Lay bumper assembly face down on a covered surface.

3. Remove two screws and shims at inner mounting bar and six screws from upper edge of panel at bumper.

4. Remove lower panel from bumper by prying with covered tool.

b. Installation (Fig. 14-4)

1. Position lower panel to bumper.

2. Secure lower panel with two screws and shims at inner mounting bar and six screws at upper edge of panel at bumper.

3. Install rear bumper assembly as described in Note 6b.

10. Center Section Filler Panel— Right or Left— Removal and Installation

a. Removal (Fig. 14-4)

1. Remove rear bumper assembly as described in Note 6a.

2. Remove six nuts and three retainers securing filler panel to bumper and remove filler panel.

b. Installation (Fig. 14-4)

1. Position filler panel to rear bumper, add retainers and secure with six nuts.

2. Install rear bumper assembly as described in Note 6b.

11. License Guard Escutcheon— Removal and Installation

a. Removal (Fig. 14-4)

1. Remove eight screws securing license plate light and license guard excutcheon to bumper.

2. Lift license plate lights from bumper, disconnect and remove from vehicle.

3. Remove license guard escutcheon.

b. Installation (Fig. 14-4)

1. Position license guard escutcheon in bumper.

2. Install license plate lights in position and connect at body panel.

3. Secure lamps and escutcheon with eight screws.

12. Fuel Tank Filler Door—Removal and Installation

a. Removal (Fig. 14-4)

1. Remove license guard escutcheon as described in Note 11a.

2. Working behind license plate, remove four screws with flat washers securing filler door angle bracket to bumper and remove filler door.

b. Installation (Fig. 14-4)

1. Position fuel tank filler door assembly in bumper and secure with four screws.

2. Install license guard escutcheon as described in Note 11b.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
280M	Front Bumper Mounting Bar to Frame	1/2-20	50
280M	Rear Bumper Mounting Bar to Frame	1/2-20	50
280M	Front or Rear Bumper Mounting Bar to Bumper	1/2-20	45
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.			

BUMPERS

The service information that follows pertains only to the Fleetwood Eldorado. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as given in the first part of this section.

GENERAL DESCRIPTION

The front bumper assembly for the Fleetwood Eldorado is a four-piece design featuring a projecting center section with replaceable outer ends and an integral lower grille, Fig. 14-5.

The rear bumper assembly consists of two end bars and a center bar with provisions in the center bar for license plate mounting. The rear bumper also provides mounting for the twin back-up light assemblies, Fig. 14-7.

SERVICE INFORMATION

13. Front Bumper Assembly—Removal and Installation

a. Removal (Fig. 14-5)

1. Raise front end of car and support on jackstands.

2. Remove two upper tie strut attaching bolts.

3. Remove two bolts with nuts and flat washers, securing right inner mounting bar to frame.

4. Repeat Step 3 for left inner mounting bar.

5. Loosen two nuts with flat washers securing right outer mounting bar to bumper.

6. Repeat Step 5 for left outer mounting bar.

7. Remove two lower tie strut attaching nuts and remove tie struts.

8. Remove one screw from reinforcement rod running between bumper center section and frame.

9. Support bumper with jacks or blocks.

10. Disconnect right and left parking light assemblies.

11. Remove four nuts which were loosened in Steps 5 and 6.

12. With the aid of a helper, remove bumper assembly from car.

b. Installation (Fig. 14-5)

1. Install tie struts in their proper location in the bumper.

2. With the aid of a helper, move bumper into position, guiding the outer locating bolts into proper position in the outer mounting bars. Support bumper with jacks or blocks.

3. Loosely install two nuts with flat washers securing right outer mounting bar to bumper.

4. Repeat Step 3 for left outer mounting bar.

5. Loosely install two bolts with nuts and flat washers securing right inner mounting bar to frame.

6. Repeat Step 5 for left inner mounting bar.

7. Align bumper assembly as follows:

a. Horizontal alignment is obtained by means of the slots located at the inner bars to frame bolts and the outer mounting bars to center bar bolts.

b. Vertical alignment is obtained by means of the slots located at the inner mounting bars to frame bolts.

c. Fore and aft alignment is obtained by means of the slots located at the inner mounting bars to center bar bolts and the outer mounting bar to frame bolts.

8. After alignment has been obtained, tighten bolts installed in Steps 3, 4, 5 and 6 to 50 foot-pounds.

9. Install two bolts at top and two nuts at bottom of tie struts and tighten.

10. Secure center section reinforcement rod with one screw.

11. Connect both parking light assemblies.

12. Remove jack or blocks used to support bumper and lower vehicle to floor.

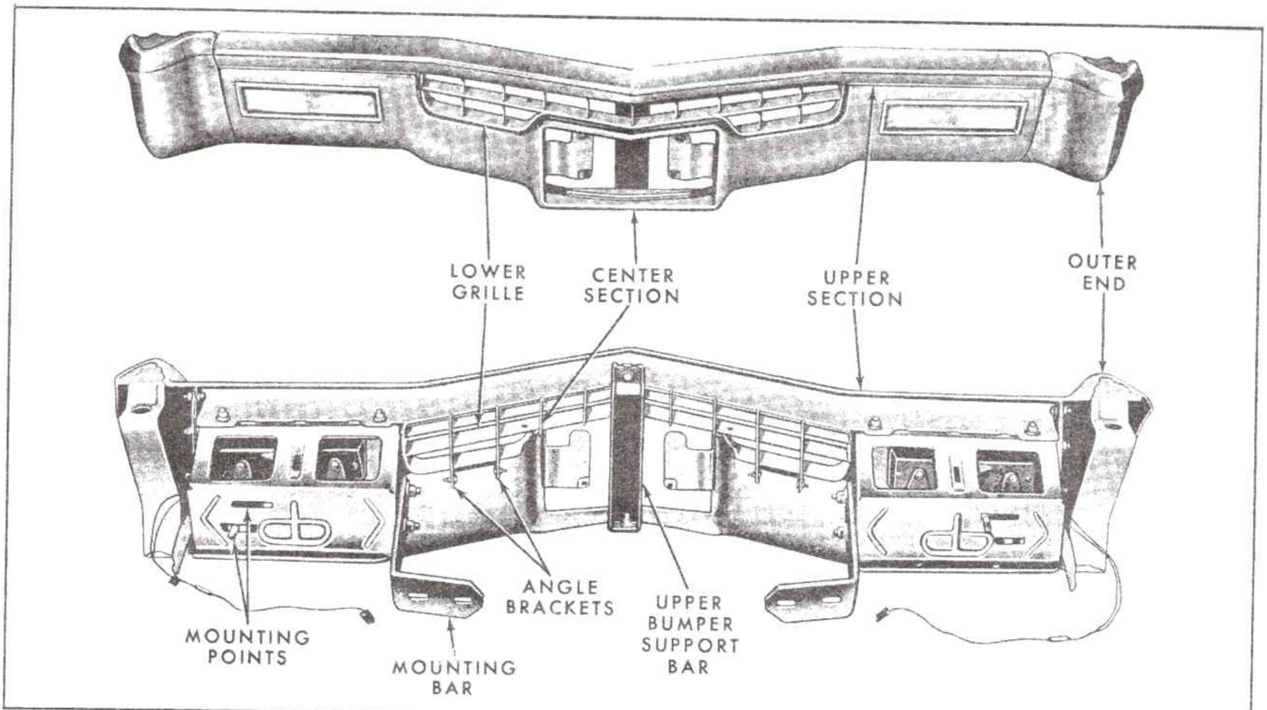


Fig. 14-5 Front Bumper - Front and Rear View

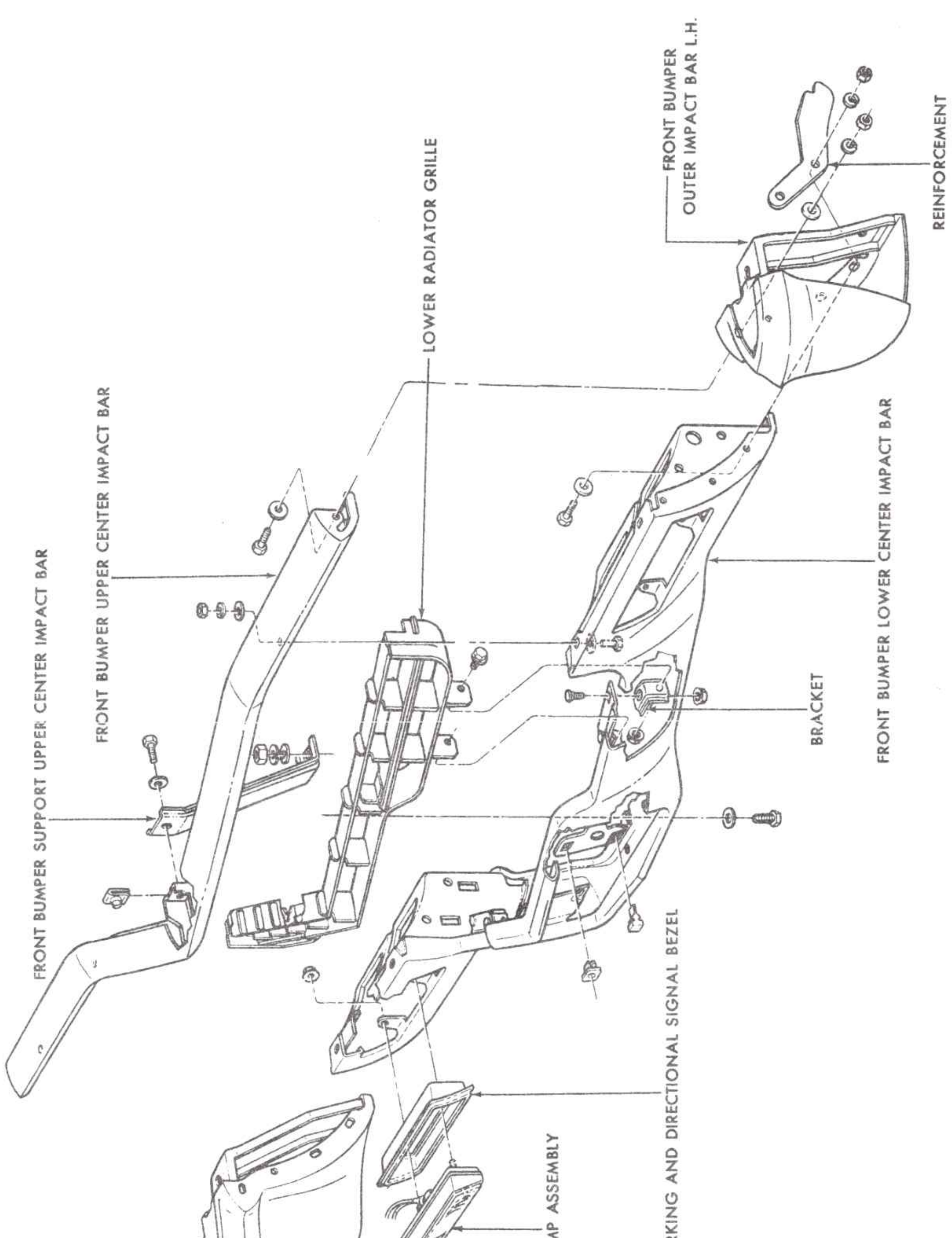


Fig. 14-6 Front Bumper - Disassembled

14. Front Bumper Outer End— Right or Left— Removal and Installation

a. Removal (Fig. 14-6)

1. Remove front bumper as described in Note 13a.

2. Support bumper center section at end being removed.

3. Remove parking light assembly as described in Section 12, Note 76a for access to outer end attaching bolts.

4. Remove four bolts, nuts and washers securing outer end to center bumper section.

5. Remove outer end with support and alignment plates from bumper assembly.

b. Installation (Fig. 14-6)

1. Position outer end with support and alignment plates to bumper assembly and loosely install four bolts, nuts and washers that secure outer end to bumper assembly.

2. Align outer end with center assembly and tighten all bolts.

3. Install parking lamp assembly as described in Section 12, Note 76b.

4. Install bumper assembly as described in Note 13b.

15. Front Bumper Upper Impact Bar— Removal and Installation

a. Removal (Fig. 14-6)

1. Remove front bumper assembly as described in Note 13a.

2. Remove both outer ends as described in Note 14a.

3. Remove two screws securing impact bar support.

4. Remove four bolts with lock washers and flat washers securing upper impact bar to center section.

5. Remove upper impact bar.

b. Installation (Fig. 14-6)

1. Locate upper impact bar in approximate position.

2. Loosely install four bolts with lock washers and flat washers which secure upper impact bar to center section.

3. Install upper impact bar support and secure with two screws.

4. Tighten four bolts securing upper impact bar to center section to 50 foot-pounds.

5. Install both outer ends as described in Note 14b.

6. Install front bumper assembly as described in Note 13b.

16. Front Bumper Center Section— Removal and Installation

a. Removal (Fig. 14-6)

1. Remove front bumper assembly as described in Note 13a.

2. Remove both outer ends as described in Note 14a.

3. Remove upper impact bar as described in Note 15a.

4. Remove lower grille assembly as described in Section 13, Note 13a.

b. Installation (Fig. 14-6)

1. Install lower grille assembly as described in Section 13, Note 13b.

2. Install upper impact bar as described in Note 15b.

3. Install both outer ends as described in Note 14b.

4. Install front bumper assembly as described in Note 13b.

17. Rear Bumper Assembly— Removal and Installation

a. Removal (Fig. 14-7)

1. Raise rear end of car and support on jackstands.

2. Remove three wiring connectors.

NOTE: If any shims are used between body and bumper, note their number and arrangement for use during installation.

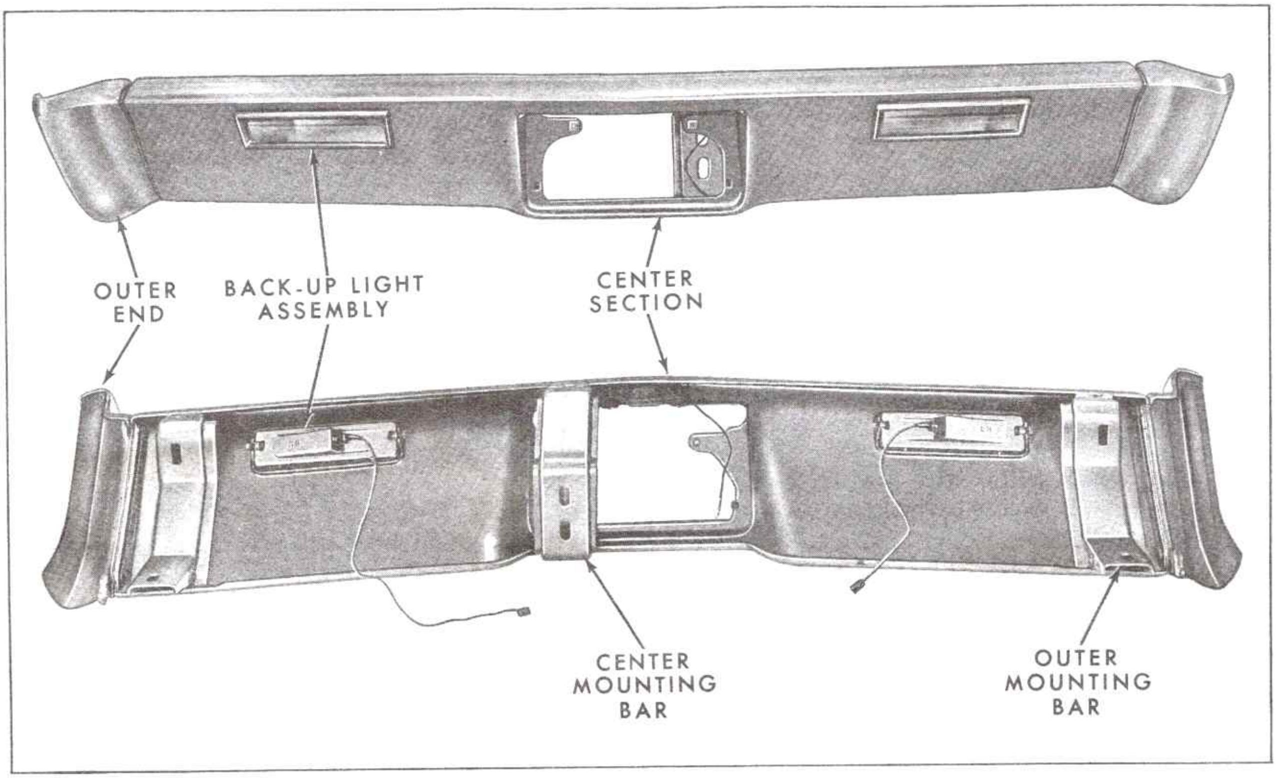


Fig. 14-7 Rear Bumper - Front and Rear View

3. Remove one screw with washer from lower mounting hole of outer mounting bar on each side.

4. Remove one screw and flat washer securing center mounting bar to body; accessible from behind license plate.

5. Working from inside trunk, remove two nuts and washers securing outer mounting bars to body.

6. Remove bumper assembly by pulling straight out.

b. Installation (Fig. 14-7)

1. Install proper number of alignment shims on mounting stud for outer mounting bar and secure shims with retainer clip.

2. Position bumper in location on body and loosely install retaining nuts and sealing washer from inside trunk.

3. Install shims at outer mounting bar, lower mounting holes and loosely install bolt with washer at both positions.

4. Install shims at center mounting bar and loosely install two screws with washers.

5. Tighten bolts and nuts installed in Steps 2, 3, and 4 to torque shown on Page 14-14.

6. Connect three wiring connectors.

7. Remove jackstands and lower vehicle to ground.

18. Rear Bumper Outer End—Right or Left—Removal and Installation

a. Removal (Fig. 14-8)

1. Raise rear end of car and support on jackstands.

2. Remove three screws securing reinforcement plate and bumper outer-end to center section. Remove retainer plate and bumper outer end.

b. Installation (Fig. 14-8)

1. Position bumper outer end to center section with retainer plate on inside of center section and reinforcement plate on inside of outer end, at the lower two holes.

2. Loosely install three screws from outer end side.

3. Align outer end to center section and tighten to 50 foot-pounds.

4. Remove jackstands and lower car.

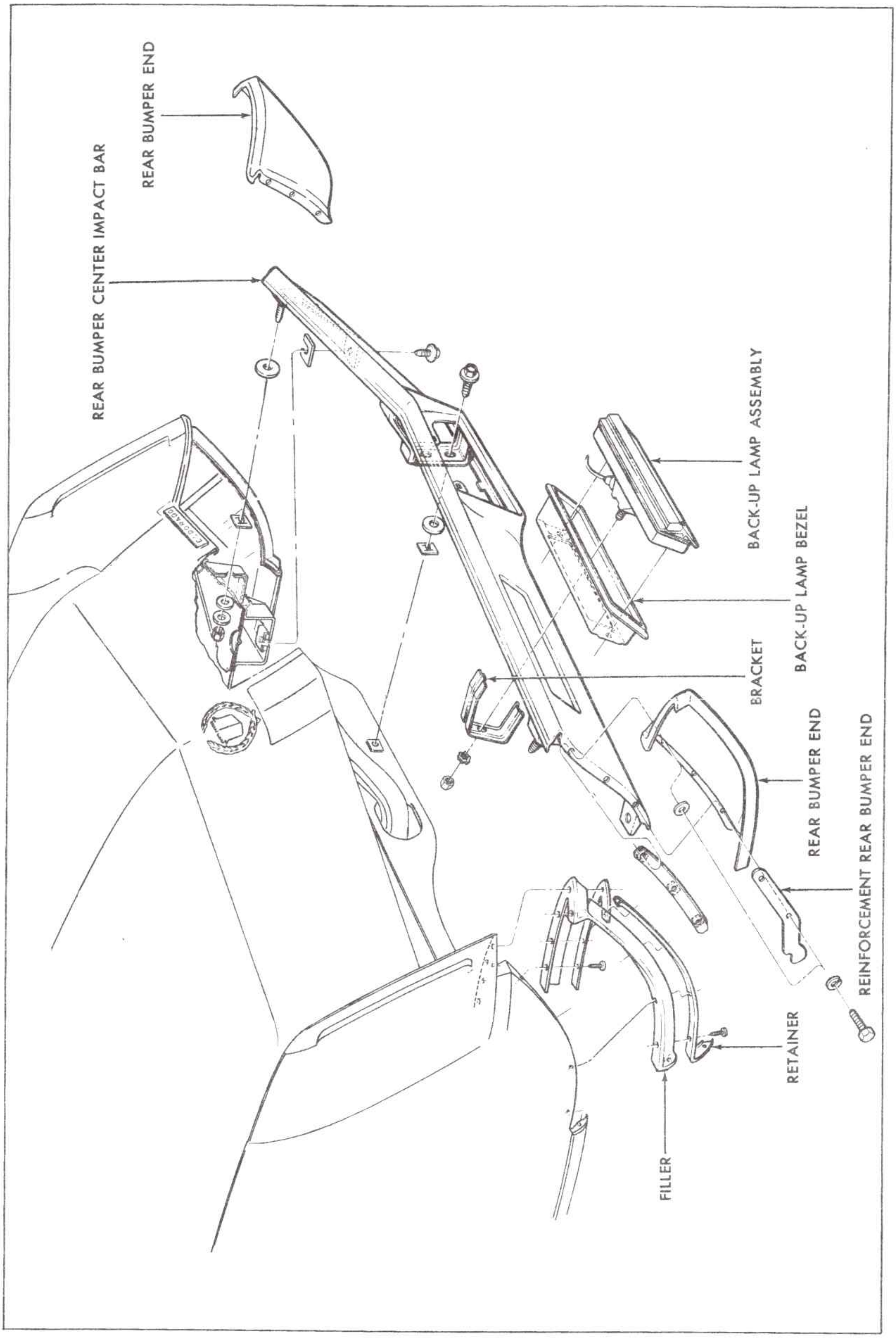


Fig. 14-8 Rear Bumper - Disassembled

19. Rear Bumper Center Section—Removal and Installation

a. Removal (Fig. 14-8)

1. Remove rear bumper as described in Note 17a.

2. Remove both end bars by following the procedure in Note 18a.

3. Remove one nut and washer from back-up lamp bracket on each side and remove both back-up lamp assemblies.

4. Remove two screws and spacers securing license plate lamp to center section and remove license plate lamp.

5. Remove two screws securing license plate to bumper and remove license plate.

b. Installation (Fig. 14-8)

1. Install license plate. Secure with two screws.

2. Position license plate lamp in center section and secure with two screws and spacers.

3. Position right back-up lamp assembly in center section and secure with one nut with washer behind bracket.

NOTE: Back-up lamp assemblies are marked on back of housing whether right or left hand side.

4. Repeat step #3 for left hand back-up light.

5. Install both outer ends as described in Note 18b.

6. Install bumper assembly as described in Note 17b.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
280M	Front Bumper Mounting Bar to Frame	1/2-20	50
280M	Rear Bumper Mounting Bar to Body	1/2-20	85
280M	Front or Rear Bumper Mounting Bar to Bumper	1/2-20	45
280M	Radiator Tie Strut	1/2-20	35
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings, and steel classifications.			

TABLE OF CONTENTS

GENERAL DESCRIPTION

RADIO & ANTENNA

Four radios are available as optional equipment for 1967 cars -- an AM/FM radio, Fig. 15-1, an AM signal seeking radio, Fig. 15-2, an AM Signal seeking radio for 697 styles (rear remote control) and an AM/FM stereo radio, Fig. 15-3. The signal seeking radios and the AM/FM radio consist of an all-transistor receiver unit and two separate speaker units. The stereo radio consists of an all-transistor receiver unit, a separate dual channel audio amplifier unit, and four separate speaker units. The radio receiver unit is located near the center of the instrument panel in all models. The dual channel audio amplifier unit that is used on stereo installations mounts to the right of the radio.

On AM/FM stereo radios, the left front and right rear speakers use one channel and the right front and left rear speakers are on the remaining channel.

On non-stereo installations, the front speaker is mounted near the center of the upper instrument panel cover. The rear speaker is located in the trunk compartment and is attached to the rear parcel shelf, except on convertible styles, where it is located in a recessed section of the rear seat back. On stereo installations, there are two 3-1/2 inch round speakers on each side of the upper instrument panel cover and two 6 inch x 9 inch speakers on each side of the rear shelf. On convertibles, the rear stereo speakers are mounted in the top well.

All receivers are equipped with five pushbuttons. The pushbutton feature provides the owner with a choice of five favorite stations. Any of these five stations is mechanically tuned in by depressing one of the five pushbuttons, located directly below the dial. The pushbuttons may be used for AM or FM reception depending upon the position of the band mode switch.

The same antenna, of the extendable rod type, is provided for all radios. It is electrically operated from the interior of the car by the manual selector control knob, which is located immediately to the left of the dial. Pushing in on this control knob will raise the antenna; pulling it out will lower the antenna.

The antenna is operated by a reversible electric motor. The motor drives a gear and pulley assembly that extends or retracts a nylon cable fastened to the smallest of three antenna sections. The action of the nylon cable, as it is extended, forces the antenna rod upward.

In lowering the antenna, the nylon cable is retracted. This pulls the three sections of the antenna rod downward.

CAUTION: Do not raise or lower the antenna by hand. Always use the antenna control knob, otherwise the operating mechanism may be damaged.

On cars equipped with AM/FM or AM/FM stereo receivers, the antenna tip should be approximately thirty inches above the fender to obtain the best FM reception. (Higher or lower heights produce more fading or flutter).

AM/FM and AM/FM Stereo Radio

The AM/FM and AM/FM Stereo Radios have advantages and limitations that must be explained to owners who are not familiar with the operation of FM units.

The frequencies (88-108 MC) at which FM stations operate create much shorter radio wave lengths than those produced in AM broadcasting. Unlike AM signals, FM signals do not bend around the horizon. This limits the distance at which FM signals can be received. The dependable range of FM transmission is a radius of approximately twenty miles from the transmitting antenna.

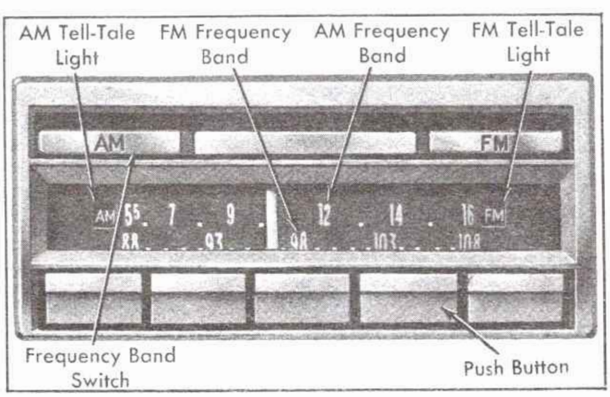


Fig. 15-1 AM/FM Receiver Dial

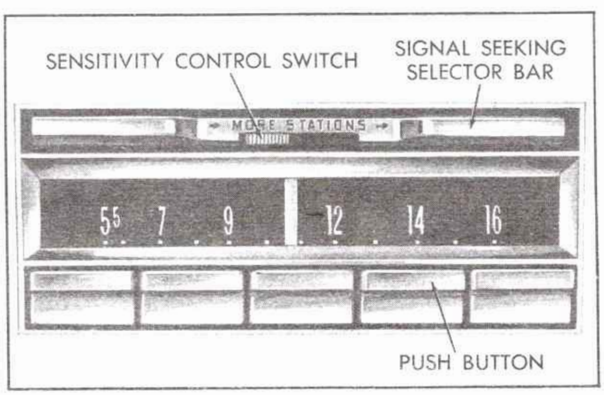


Fig. 15-2 AM Receiver Dial

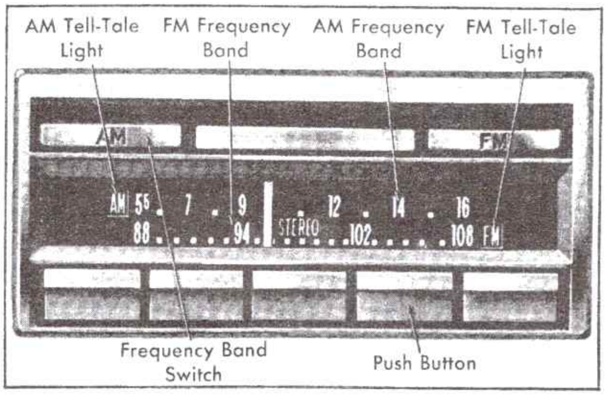


Fig. 15-3 AM/FM Stereo Dial

However, a strong FM signal can be picked up in areas of primary coverage where AM signals are weak. An example of this circumstance is in tunnels and underpasses. The reason is that the shorter FM signals are easily reflected and scattered by surrounding objects.

When the FM receiver moves out of range of the FM transmitter, it enters what is referred to as the fringe area. In the fringe area, the strength of the FM signal may vary rapidly, causing a flutter or a series of noise bursts as the car moves between high and low level signal points.

A second effect found in the fringe area is the presence of ignition interference from adjacent vehicles. In both instances, it may be possible to improve reception by retuning; however, it may be necessary to change to a different station, if reception still is not good.

Retuning should only be necessary in those few instances when reception becomes slightly noisy while driving through such areas as the center of a large city and a weak signal is being received from a station located away from the center of the city. The interference can be quieted by adjusting the tone control for more bass, and by shifting the speaker fader to favor the rear seat.

While these adjustments will slightly diminish stereo effect on cars so equipped, they will substantially reduce background noise interference.

As soon as reception clears, reset the tone control to the normal detent and again adjust the front and rear speakers for equal output.

Properly used, the AM/FM radio or AM/FM Stereo offers several distinct advantages over the AM radio. The FM reception is relatively free from static, whether caused by nature, as in thunderstorms, or by mechanisms such as power lines, viaducts, and neon lights. Unless the receiver is tuned to a very weak signal, reception should be virtually noise free.

The Cadillac AM/FM or AM/FM Stereo Radio is equipped with automatic frequency control, which aids tuning to a station. The FM receiver should be turned directly on station frequency for minimum noise interference; however, the automatic frequency control will tune directly to and lock on station frequency when slight mistuning is encountered.

Another feature of FM tuning is signal separation. When two FM stations are close in frequency, the FM tuner selects the stronger signal, completely rejecting the weaker one. This is in contrast to AM performance, where it is not always possible to separate two stations.

The Cadillac AM/FM Radio incorporates an AM receiving circuit and an FM receiving circuit, both of which are of all-transistor construction. The audio system is common to both receiving circuits.

The Cadillac AM/FM Stereo Radio incorporates an AM receiving circuit, an FM receiving circuit and stereo detection circuit. A dual channel audio amplifier on a separate chassis mounts to the right of the radio and is not visible from the passenger compartment. Each circuit is of all-transistor construction.

The signal seeking feature is not provided on the AM/FM or AM/FM Stereo radio. An AM/FM frequency band switch is located above the frequency band on the receiver dial, in place of the selector bar.

Located on either side of the AM frequency dial are tell-tale lights that indicate, when illuminated, the frequency band in use. The AM tell-tale light is located on the left side of the dial, and the FM tell-tale light is found at the right side. On the stereo model, stereo indicator bulbs in the center of the dial, as shown in Fig. 15-3, light when the FM station tuned is capable of transmitting stereo. The illumination of these bulbs, however, does not always mean the station is transmitting stereo at the particular moment. The bulb will not light on any AM station, since stereo programs are not broadcast on this band.

Signal Seeking Tuner

The signal seeking tuner, provided on AM radios, is electronically controlled so that the operator may change stations by depressing the selector bar. The signal seeking operation consists of a low to high frequency sweep (left to right) of the broadcast band by the tuner.

When the selector bar is depressed, the tuner moves to the station of next higher frequency (to the right) and stops automatically at the point where that station is best received. This action takes place each time the selector bar is

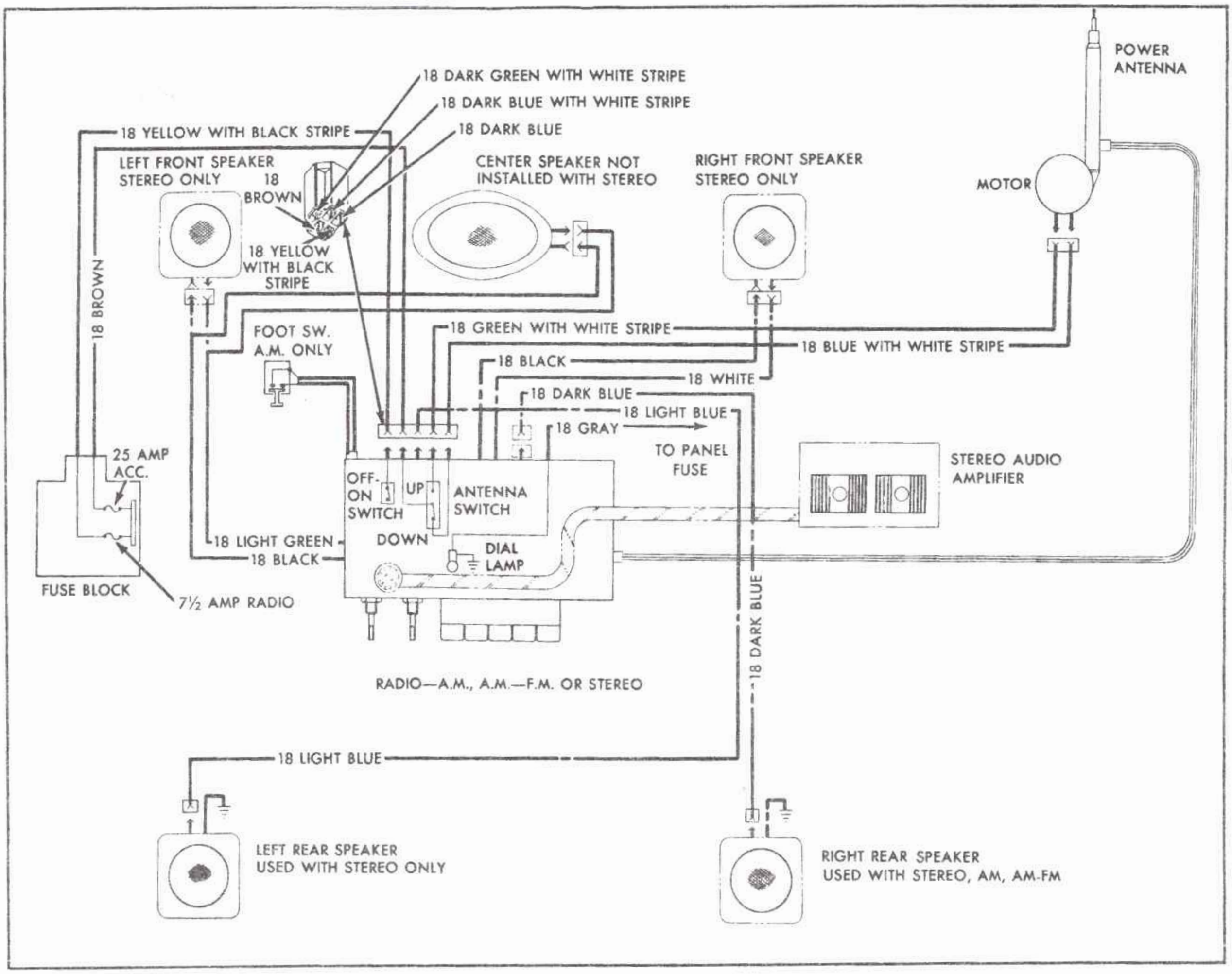


Fig. 15-4 Radio Circuit Diagram

depressed. When the tuner has reached the point of highest frequency of the broadcast band, it returns to the low frequency (left) side of the broadcast band and begins a new sweep to the right, stopping at the first receivable station. The above procedure is then repeated when the bar is again depressed.

A foot control switch, which performs the same station selecting function as the station selector bar, is available on all AM radios for dealer installation.

The stopping sensitivity of the signal seeking tuner may be varied by changing the position of the three-position sensitivity control switch located just below the center of the selector bar.

The circuit diagram for radios is illustrated in Fig. 15-4.

SERVICE INFORMATION

1. Radio Controls, Operation

a. Switch Volume and Tone Control (AM, AM/FM Radios or AM/FM Stereo Radios)

The left knob turns the radio ON and OFF, and controls the volume. On the stereo radio, the knob controls the volume in both channels simultaneously. The ring is turned counterclockwise for bass tones and clockwise for treble tones. When indexed at the detent, it provides a balanced normal tone. On the stereo radio, this control varies the tone in both channels simultaneously.

For best stereo reception, neutralize the tone control by turning it to the center detent position, then adjust the front and rear speaker control as outlined in sub-section b of this note so that the sound is balanced to your ears. Centering the tone control permits full frequency response from the speakers, and balanced speaker output is needed for greatest stereo effect.

The radio will play immediately when turned ON, due to the all-transistor construction of all circuits.

b. Manual Station Selector and Speaker Control (AM, AM/FM or AM/FM Stereo Radios)

The right knob is used to tune stations manually.

The ring on the knob is the speaker control. When the ring is turned all the way clockwise, on AM and AM/FM models, volume of the front speaker is increased. As the ring is turned counterclockwise, the front speaker volume decreases while the rear speaker volume increases. When the ring is turned all the way counterclockwise, the rear speaker is stronger. Adjusting this ring will balance the volume between the two speakers to please the driver and passengers.

On AM/FM stereo models, adjusting the ring changes the volume between the front pair of speakers and the rear pair of speakers. If the ring is in a complete clockwise position, volume of the front pair will be louder. If the ring is in a complete counterclockwise position, volume of the rear pair of speakers is louder. This control has no effect on the balance of stereo channels.

c. Push Button Tuning (AM, AM/FM or AM/FM Stereo Radios)

After the five pushbuttons are set to the owner's five station selections, it is necessary only to push any button to tune in the station for which the button is set, and the corresponding band switch on AM/FM or AM/FM Stereo radios.

AM/FM Stereo radios should always be fine-tuned to assure maximum signal response, even though it was pre-set by the push-button control.

d. Automatic Tuning (AM Radios Only)

To use automatic tuning, depress the selector bar above the dial momentarily. Any station within range of the receiver can be obtained by holding the bar depressed until the dial pointer approaches the desired frequency, and then releasing the bar. The automatic tuner will seek immediately when the selector bar is depressed, due to the all-transistor circuitry.

e. Sensitivity Control (AM Radios Only)

The three-position slide switch, located below the center of the selector bar, controls the station selecting sensitivity of the signal seeking tuner. By moving the switch to its most sensitive position (right), it is possible for the tuner to pick up all receivable stations by depressing the selector bar. When the switch is moved to its intermediate position (center), the tuner will not select any of the weakest stations, and with the switch in its least sensitive position (left), only the strong stations will be selected.

f. Frequency Band Switch (AM/FM or AM/FM Stereo Radios Only)

The frequency band switch is located above the frequency dials. Depressing the left side of the band switch connects the radio for AM reception, and illuminates the AM tell-tale light located on the left side of the dial. Depressing the right side of the band switch connects the radio for FM reception, illuminating the FM tell-tale light located on the right side of the dial. Stereo broadcasts can be received on the FM band only.

g. Rear Seat Remote Control—697 Styles (AM Radios Only)

A rear seat radio remote control is available as an accessory for 697 style cars equipped with the signal seeking AM radio. The remote control consists of an ON-OFF volume control, a sensitivity control, and a selector button. It is located in the right rear arm rest.

The rear seat remote control overrides the front radio controls. Once the remote control is turned ON, the front controls, with the exception of the pushbuttons and manual tuner, will not operate the radio until the remote control is turned OFF.

The ON-OFF volume control knob turns the radio ON and OFF, and controls the volume. The sensitivity control is located beneath the ON-OFF volume control knob. Rotating the control counterclockwise permits the tuner to stop only on the strong signals. In the middle position, the tuner will stop on weaker signals. Rotating the control clockwise permits the tuner to stop at the weakest receivable signals.

When the remote control is ON, the red selector button is illuminated. Depressing this button performs the same function as pressing the selector bar.

2. Radio Noise Suppressors

a. Static Collectors

Ordinarily, the front wheels will not create radio static. However, if a crackling noise is heard from the radio when the car is in motion and disappears as brakes are applied, static collectors should be installed in both front wheels in service.

Front wheel static collectors consist of helical coil copper inserts. If necessary, they should be installed in the front hub dust caps against the steering knuckle spindles. The areas they are grounded against must be free of grease or oil to assure proper operation.

Care must be taken before installing the dust cap to peen over the end of the spindle nut cotter key until it is flat against the side of the nut. This will prevent the static collector from catching on the cotter key and breaking.

b. Ignition Suppressors

Various types of ignition suppressors are used to prevent spark noise from interfering with radio

reception. Failure of any of these parts to function properly is accompanied by a popping noise. The noise increases as the engine is accelerated, and varies with engine speed. If this interference is present, check the following suppressors:

1. Ignition noise is suppressed by use of resistance core ignition cables. Check for a defective or open cable. The resistance of these cables is 2,000 to 6,000 ohms per foot. The use of the secondary efficiency test, Section 6, Note 34, is helpful in testing for defective ignition cables.

2. Two ground cables, one from each of the upper suspension arms, should be checked for breaks and proper ground contact on all but 693 styles.

3. Two ground straps, one from each cylinder head to cowl, should be checked for breaks and proper ground contact on all but 693 style.

4. On all but 693 style, check ground cable from negative battery cable at frame to radiator cradle.

5. On 693 style check ground cable between transmission housing and dash, in the generator right dust shield (in harness), and the radiator cradle to frame.

6. A capacitor mounted on the outside of the ignition coil may be checked by running engine at medium speed and then quickly turning ignition switch to the Accessory position. If the noise is eliminated, while the engine is coasting to a stop, replace faulty coil capacitor.

7. It is particularly important that the terminals in the ignition secondary cables make good mechanical contact with the spark plug terminals and distributor cap terminals. Failure at these points will result in excessive ignition noise, seriously reducing FM performance.

c. Regulator Capacitor

A capacitor is mounted on the regulator to prevent regulator operation from interfering with radio reception. A whining sound that increases in pitch as engine speed is increased is an indication of a faulty regulator capacitor. If replacing the regulator capacitor fails to eliminate the whining, the capacitor built into the end frame of the generator is probably defective and should be replaced. A defective diode in the generator can also cause this noise.

d. Blower Motor Capacitor

A capacitor is mounted on blower motor assembly for radio noise at high blower speed on cars equipped with AM/FM or AM/FM Stereo radio. If Automatic Climate Control or heater is turned OFF and whine is eliminated, this capacitor should be replaced.

e. Antenna Motor and Engine Electrical Noise

Excessive antenna motor and engine electrical noise is often caused by the antenna lead-in cable

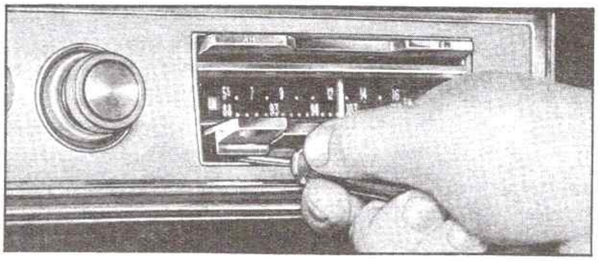


Fig. 15-5 Adjusting Antenna Trimmer

ferrule not being properly installed. This condition can be corrected by removing, and then reconnecting the antenna lead-in cable, and tightening retaining nut.

3. Minor Adjustments

a. Antenna Trimmer Adjustment

1. Turn radio on.

NOTE: On cars equipped with AM/FM receivers, the receiver must be set for AM reception.

2. Extend antenna fully.

3. Tune in a weak station between 600 and 1200 KC on AM band and turn volume control to maximum.

4. Adjust antenna trimmer, located behind left pushbutton, for maximum volume. Access to antenna trimmer is gained by pulling out left pushbutton and working through opening under pushbutton, Fig. 15-5.

NOTE: If, during adjustment, the station becomes strong, tune to a weaker station and continue the adjustment.

5. After adjusting the trimmer for best AM reception, check performance of the FM band on AM/FM radios. It may be necessary to adjust the antenna height. To obtain best FM reception, the tip of the antenna should be approximately 30 inches above the fender.

b. Push Button Station Selection

1. Unlatch push button by pulling it straight out.

2. Tune in desired station for optimum reception and then push button in all the way. Whenever this button is pushed, the pre-set station will be selected.

3. Repeat above procedure for the four remaining buttons.

c. Balance Adjustment (AM/FM Stereo Models Only)

If the sound appears to be louder on one side

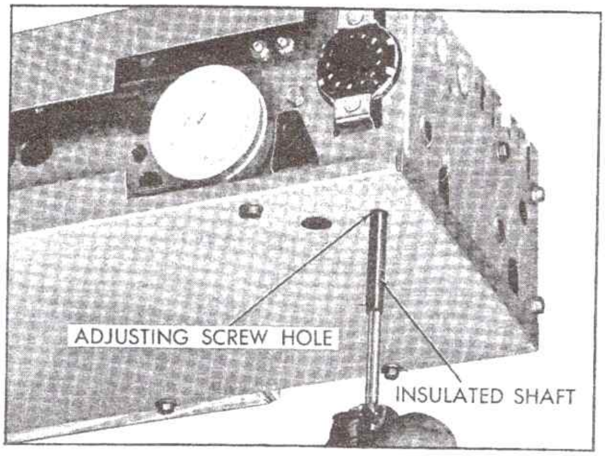


Fig. 15-6 Stereo Balance Adjustment

of the car than the other, an adjustment called the balance adjustment may be made.

CAUTION: On some stereo programming, it is normal for one side to be louder than the other for a short time. This is done purposely for stereo effect. The only positive method to tell if the balance control needs adjustment is to tune in a non-stereo program and make a critical evaluation, in which the owner may assist.

If the adjustment is needed, proceed as follows:

1. Remove ash tray housing assembly, as described in Section 12, Note 54a.

2. With radio playing and fader control turned fully clockwise, insert long screwdriver with insulation on shaft through opening on lower rear left corner of radio, Fig. 15-6. Rotate balance control adjustment clockwise or counterclockwise until the sound in the left and right speakers appears to have equal volume.

NOTE: Be sure that screwdriver shaft is insulated or fuse may blow.

3. Install ash tray housing assembly as described in Section 12, Note 54b.

4. Minor Repair Procedures

Many conditions that affect radio operation may be corrected without removing set from car. Check condition and, using diagnosis chart at end of Section, perform the operation or operations necessary to correct the condition. If these minor repairs are not effective, radio should be removed from car and repaired at an authorized radio service station.

CAUTION: Do not turn on radio with either speaker disconnected, as the audio transistor may be permanently damaged.

a. Fuse (AM/FM Stereo Radios Only)

To check condition of the fuse, turn radio on and check operation of either radio tell-tale light. If light does not light, it is an indication that fuse is blown. Check fuse and replace with one of correct amperage.

b. Fuse (AM Radios Only)

A thump should be heard when the radio is turned on. If thump is not heard, check fuse and replace with one of correct amperage. If fuse blows the second time during signal seeking and return operation, the radio should be sent out for repairs.

c. Battery

Check battery and make sure that it is fully charged.

d. Speaker Connections

Check speaker leads for possible open circuit or ground. Remember, there are four speakers in stereo installations.

e. Antenna

Use a test antenna and lead-in plugged into the set with test antenna held outside car. If radio works satisfactorily with this test assembly, car antenna should be checked for a short or ground, and lead-in should be checked for continuity. Test antenna mast for shorts to ground while wiggling antenna.

If a ground is indicated in this test, disassemble antenna and check for defective insulators or presence of water or moisture in body tube. Test with volt-ohm meter from end of either lead-in tip to ground. If lead-in test shows a ground, replace lead-in.

The conditions mentioned above will cause a weak or intermittent signal and will cause signal seeker to sweep back and forth across the dial when tuning bar is depressed while car is in an unusually weak signal area, such as in a building or under a viaduct. The mast assembly must be raised slightly above the fender for radio reception. Do not remove the set to correct this condition until all previous checks on the antenna have been made with the car in a fairly strong signal area.

f. Antenna Trimmer

If antenna is not trimmed, the set will have weak and fading AM reception. Antenna trimming should always be performed before the new car is delivered or after any repair work is completed. See Note 3a.

5. Radio Receiver Unit

The procedure for removing and installing the

radio receiver unit is described in Section 12, Note 50.

6. Audio Amplifier Unit

The procedure for removal and installation of the audio amplifier unit is described in Section 12, Note 51.

7. Radio Front Speaker

The procedure for removing and installing the radio front speaker or speakers is described in Section 12, Note 52.

8. Radio Rear Seat Speaker—Except Convertibles

a. Removal

NOTE: Access to rear speaker is gained through trunk compartment.

1. Disconnect speaker lead (dark blue) from connector at rear of speaker. This is a light blue lead on the AM/FM Stereo left rear speaker.

2. Remove four nuts securing speaker to rear compartment shelf and remove speaker.

b. Installation

1. Install speaker to rear compartment shelf and tighten four attaching nuts evenly to a maximum of 12 inch-pounds to prevent speaker distortion.

2. Connect speaker lead (dark blue) to connector at rear of speaker. This is a light blue lead on the AM/FM Stereo left rear speaker.

9. Radio Rear Seat Speaker and Grille—Convertibles Without Stereo

Access to rear seat speaker and grille is gained through rear passenger compartment.

a. Removal

1. Remove rear seat cushion.

2. Remove rear seat back.

3. Remove valance from rear of seat back.

4. Remove four Phillips screws securing speaker assembly at rear top center of seat back.

5. Lift speaker assembly out and up at bottom of recess in center of seat back.

6. Disconnect speaker leads from speaker.

7. Remove screw securing black ground lead.

8. Remove four sheet metal screws securing speaker to baffle and remove speaker.

9. Remove four Phillips screws securing speaker grille to baffle and remove grille. It is not necessary to remove rear speaker grille when removing speaker, unless grille is to be replaced.

b. Installation

1. Install speaker grille on baffle and secure with four attaching screws.

2. Install speaker on baffle and secure with four attaching screws.

3. Secure black ground lead with attaching screw.

4. Connect speaker leads to speaker.

5. Install speaker assembly in recess in center of seat back and secure with four attaching screws.

6. Install valance on rear of seat back.

7. Install rear seat back.

8. Install rear seat cushion.

10. Radio Rear Seat Speaker—Convertibles with Stereo

a. Removal

1. Remove boot upper trim.

2. Remove four Phillips head attaching screws and remove grille.

3. Peel back boot.

4. Remove four speaker enclosure mounting screws and screw securing black ground wire.

5. Disconnect speaker lead (dark blue on right side or light blue on left side.)

6. Remove speaker assembly with enclosure.

7. Remove four nuts securing speaker to enclosure.

b. Installation

1. Install four nuts securing speaker to enclosure.

2. Position speaker with enclosure.

3. Connect speaker lead (dark blue on right side or light blue on left side).

4. Install four speaker enclosure mounting screws and screw securing black ground wire.

5. Position boot.

6. Install grille with four Phillips head attaching screws.

7. Install boot upper trim.

11. Rear Seat Remote Control Unit—(697 Styles)

a. Removal

1. Remove rear seat cushion by lifting forward edge and pulling forward.

2. Remove rear seat back by removing two screws along lower edge of back and lifting assembly off mounting hooks.

3. Remove five screws securing right quarter window garnish molding and remove molding.

4. Remove six screws retaining right arm rest assembly.

5. Remove tape securing excess cable behind arm rest assembly.

6. Remove right front and rear door sill plates.

7. Remove right front kickpad.

8. Peel back rug to gain access to harness protection conduit along right sill.

9. Remove upper instrument panel by removing five attaching screws along rear edge and pulling rearward to disengage front panel and cover attachments.

10. Disconnect cable assemblies at left rear corner of radio.

11. Remove three clips and remove cable from shroud vent duct and hinge pillar area.

12. Thread cable through harness conduit in rear partition.

13. Loosen set screw in knob assembly and remove knob assembly, felt washer, and sensitivity ring.

14. While holding control and cable assembly in one hand, remove jamb nut, radio trim plate and second jamb nut securing assembly to escutcheon.

15. Route cable out of right rear armrest assembly.

b. Installation

1. Thread plug end of cable forward through hole in line with harness conduit in rear partition.

2. Route cable to radio through hinge pillar area and along shroud vent duct.

3. Connect cable assemblies at left rear corner of radio. Ground remote control head in rear compartment. Turn on radio and test for operation. Extend antenna fully and peak antenna on weak station between 600 and 1200 kilocycles.

4. Route cable along dashboard with yellow locating tape at cable retainer and install in wiring conduit. Install three cable retaining clips.

5. Coil and tape excess cable behind armrest assembly.

6. Secure control and cable assembly to escutcheon with jamb nut.

7. Install and attach radio trim plate with second jamb nut.

8. Install sensitivity ring, felt washer and knob assembly and tighten set screw in knob assembly.

9. Install rug and right front and rear door sill plates.

10. Install right front kickpad.

11. Install upper instrument panel with five attaching screws.

12. Install right armrest assembly with six attaching screws.

13. Install right quarter window garnish molding and secure with five screws.

14. Install rear seat back on mounting hooks and secure with two attaching screws.

15. Install rear seat cushion.

12. Antenna Unit

a. Removal

1. Lower antenna.

2. Disconnect negative battery cable at battery.

3. Disconnect motor leads at plastic connector and antenna lead-in cable from support tube.

4. Loosen clamp screw retaining antenna to escutcheon.

5. Remove 7/16" screw holding antenna and bracket to right fender dustshield and remove antenna from car.

6. Escutcheon may be removed by removing retaining spring and pushing escutcheon out through top of fender.

b. Installation

1. Install escutcheon and retaining spring if

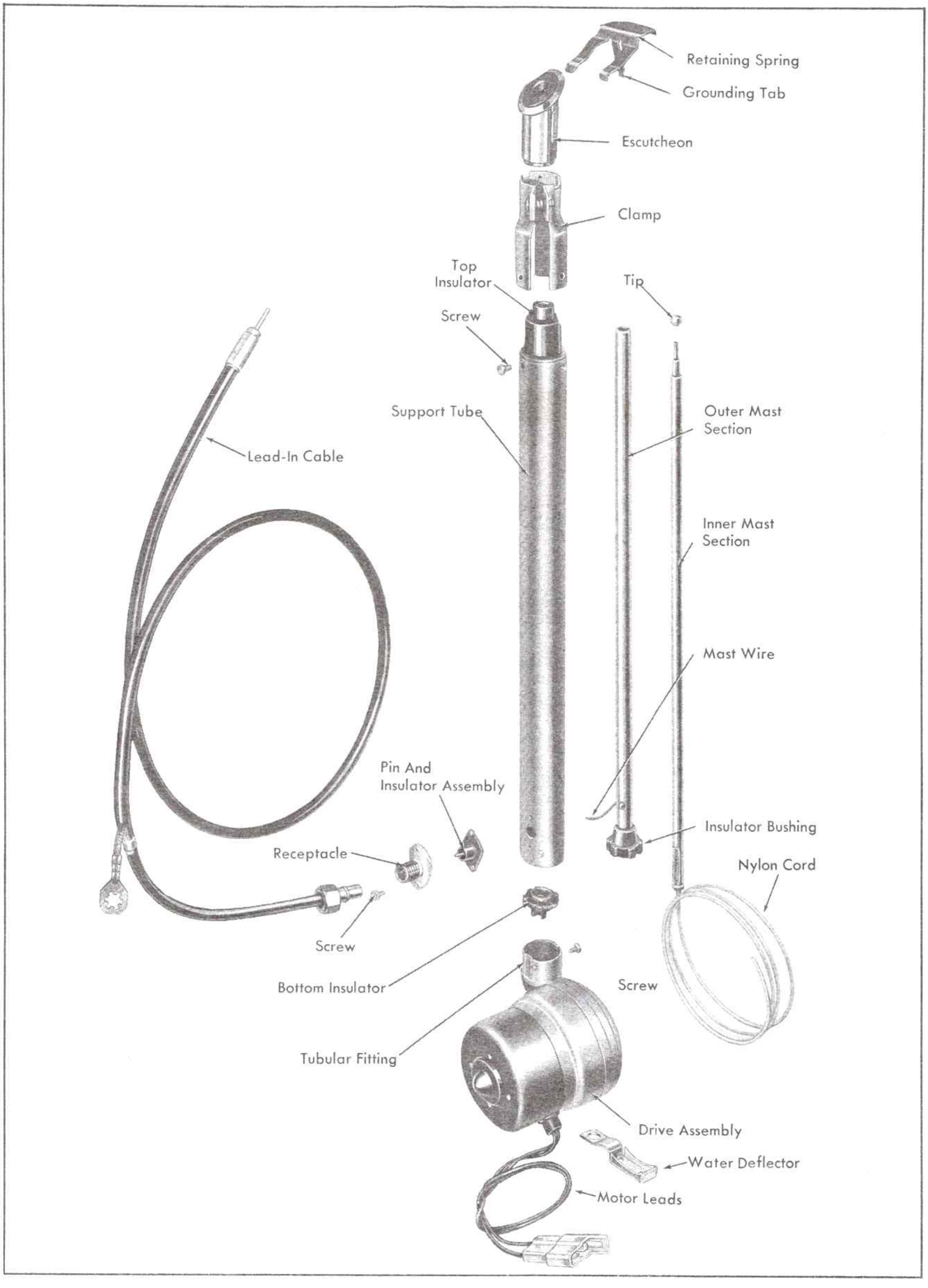


Fig. 15-7 Antenna Disassembled

previously removed.

2. Install antenna in position, being certain that antenna clamp is over grounding tab of escutcheon retaining spring.

3. Install 7/16" screw holding antenna assembly and bracket to right fender dustshield.

4. Connect lead-in cable to support tube.

5. Connect motor leads at plastic connector.

6. Tighten clamp screw retaining top of antenna to escutcheon.

7. Connect negative battery cable at battery.

8. Check operation of antenna.

13. Antenna Unit Disassembly and Assembly

a. Disassembly (Fig. 15-7)

1. Remove three screws securing retaining clamp to support tube and remove clamp.

2. Remove two screws holding lead-in receptacle to support tube and remove receptacle.

3. Unsolder mast wire from pin and insulator assembly, and separate assembly from mast wire.

NOTE: Do not overheat pin by slow soldering because excessive heat will damage insulator.

4. Remove three screws securing support tube to drive assembly and remove support tube with top insulator attached by pulling it loose from drive assembly.

5. Remove outer mast section, with insulator bushing attached, from tubular fitting on drive assembly.

6. Inner mast section with cord attached can be detached from drive assembly by applying 12 volts to motor leads while grounding motor.

NOTE: Keep cord taut to prevent kinking or bending.

7. Remove bottom insulator from tubular fitting with the aid of a small drill inserted through each of the drain holes at bottom of tubular fitting.

8. Unscrew tip from inner telescopic section.

b. Assembly (Fig. 15-7)

1. Install tip on inner telescopic section.

2. Insert bottom insulator in tubular fitting with slotted protrusion down, aligning slots of insulator with ears in tubular fitting.

3. Insert cord through bottom insulator and into drive assembly as far as possible without applying force. Then apply 12 volts to the motor leads to retract cord into drive assembly. Be certain to keep cord taut to prevent kinking.

4. Place outer mast section over inner section, aligning slots of pin and insulator assembly with ears in tubular fitting.

5. Place support tube over mast assembly, aligning tang on tube with slot provided in tubular fitting. Pull mast wire through pin and insulator hole before securing support tube with three screws.

6. Insert mast wire into pin and insulator assembly, and solder.

NOTE: Be certain to use only resin type solder. Do not overheat.

7. Position lead-in receptacle over pin and insulator assembly and secure with two screws.

8. Install clamp over support tube and secure with three screws.

14. Antenna Unit Maintenance and Repair Procedure

Many antenna troubles can be prevented by cleaning and lightly oiling the antenna rod at periodic intervals. Cleaning is easily performed at oil change intervals, or when a car is being washed, by wiping the rod with a soft cloth.

NOTE: If car has been undercoated, check to make sure that drain holes have not been plugged.

a. Moisture in Cylinder

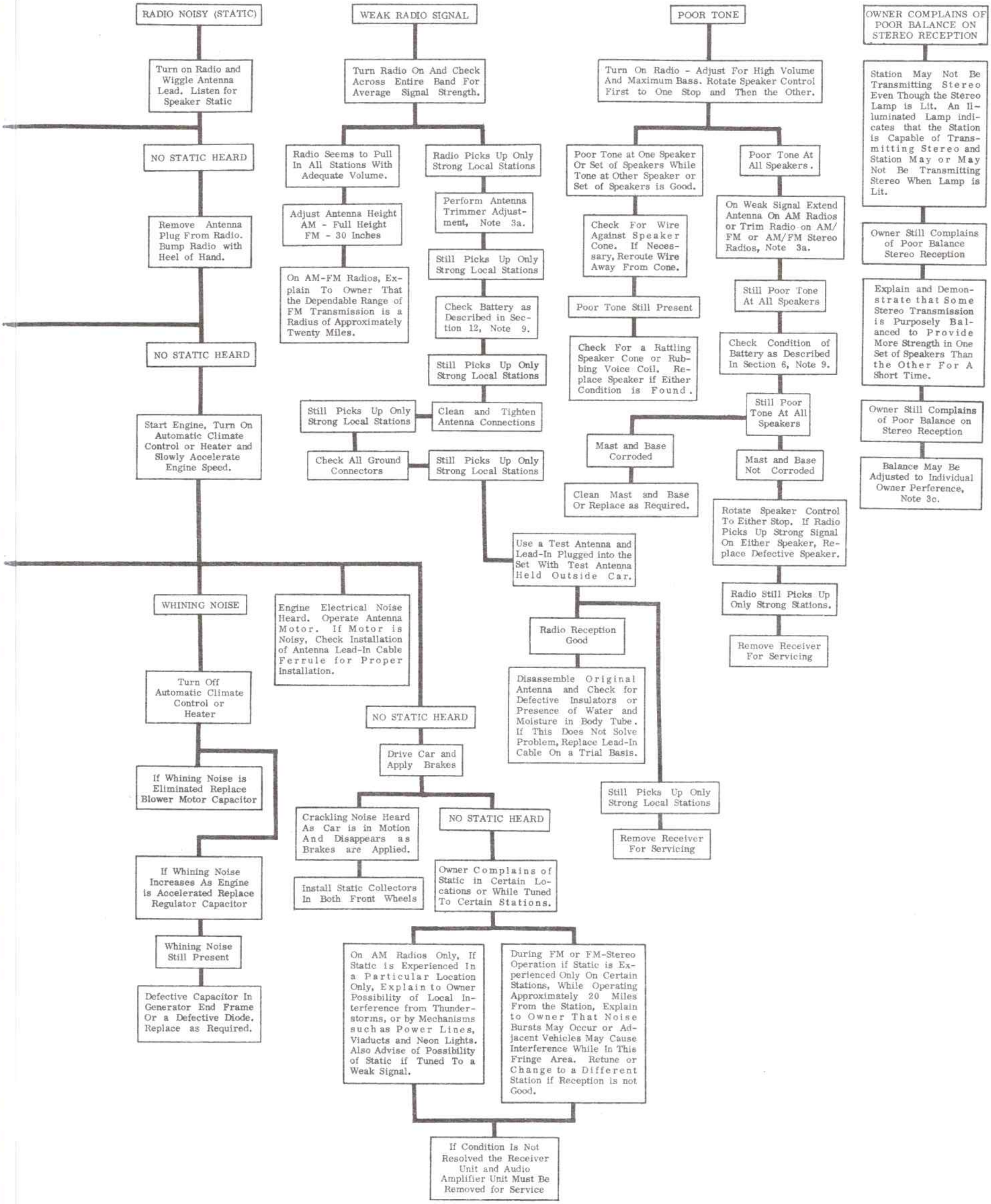
Weak reception or fading may be caused by moisture in the support tube, due to condensation or leakage through the insulating bushings. If trouble has been traced to moisture in the tube, the antenna must be removed, disassembled and thoroughly cleaned. All moisture can be removed by blowing it out with compressed air, then pushing a clean, dry cloth through the support tube, as far as possible. Before assembling antenna, check drain holes in motor housing below body tube mounting point to be sure they are not obstructed.

b. Antenna Will Not Raise or Lower

This condition can be due to a blown fuse, loose electrical connections at the switch on the receiver unit or at the antenna motor, a bent antenna mast or a loose or improperly positioned station selector knob. If a check of these causes fails to correct the condition, disassemble the antenna and replace any inoperative parts.

RADIO DIAGNOSIS CHART

RADIO DIAGNOSIS CHART



GENERAL DESCRIPTION

CRUISE CONTROL

The automatic lock-in Cruise Control is a driver-operated speed regulating device that may be used either as a speed reminder or as an automatic speed control for any car speed between 25 mph and 85 mph. It is available as optional equipment on all 1967 Cadillac cars.

The major components of the automatic lock-in Cruise Control are: the power unit, mounted on the left front fender dustshield on all but 693 series; and the selector control assembly, located on the left side of instrument panel bezel. On 693 styles the power unit is mounted on a bracket at the rear of the engine.

The power unit is driven by a flexible drive cable from the transmission, Fig. 15-8. The drive cable also drives the speedometer cable that runs from the power unit to the speedometer. The selector control assembly is connected to the power unit by means of a bowden cable. Mechanical linkage connects the power unit to the accelerator and carburetor throttle rod.

The selector control assembly is shown in Fig. 15-9. Speed settings are secured by use of a calibrated thumb wheel. The selector dial is numbered with speed markings from 30 mph to 80 mph, and increments of 5 mph from 25 mph to 85 mph. An arrow on the selector control assembly indicates the speed on the selector dial for which the unit is set when in the ON or AUTO position. The numbers on the dial are illuminated whenever the parking lights or headlights are lit.

The switch lever located on the right side of the selector dial turns the unit off and on, and activates the unit for automatic control. The switch lever is in the OFF position when rotated rearward against its stop; ON position when the lever is at the top just at the point where spring tension is felt; and AUTO position when rotated forward to the limit of its travel against spring tension.

A green indicator light, located in the top left corner of the instrument panel cluster and marked CRUISE glows whenever the unit is set for automatic control.

When the switch lever is in the OFF position, the unit has no effect at any car speed. Once the switch lever has been moved to the ON position, the unit is on and accelerator back pressure will be felt as a warning at the speed for which the selector dial is set. Moving the switch lever momentarily to the AUTO position activates an automatic relay switch in the power unit and the green indicator light in the instrument panel will glow, indicating the unit is set for automatic control. The switch, which is spring loaded, will return to the ON position. Once the unit is set for automatic control the unit will lock-in automatically whenever back pressure is felt on the accelerator pedal at the selected speed.

A reversible electric motor in the power unit actuates the mechanical linkage between the power unit and the carburetor. Motor feed points for forward and reverse energizing of the motor are closed and opened by a governor, under control of a governor spring that is compressed or relaxed

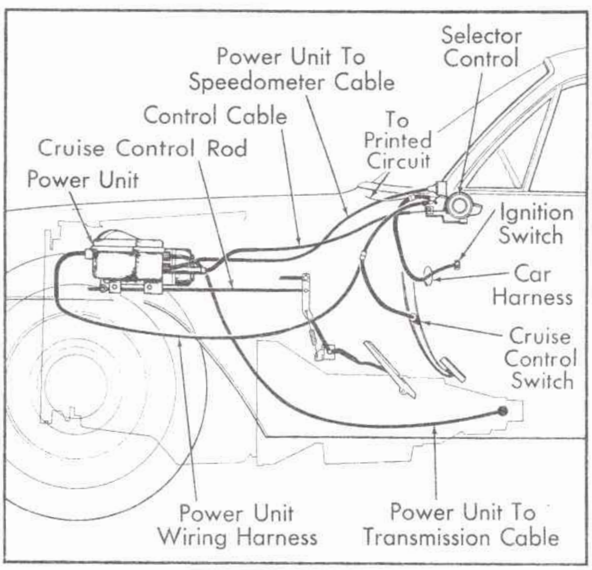


Fig. 15-8 Cruise Control Installation

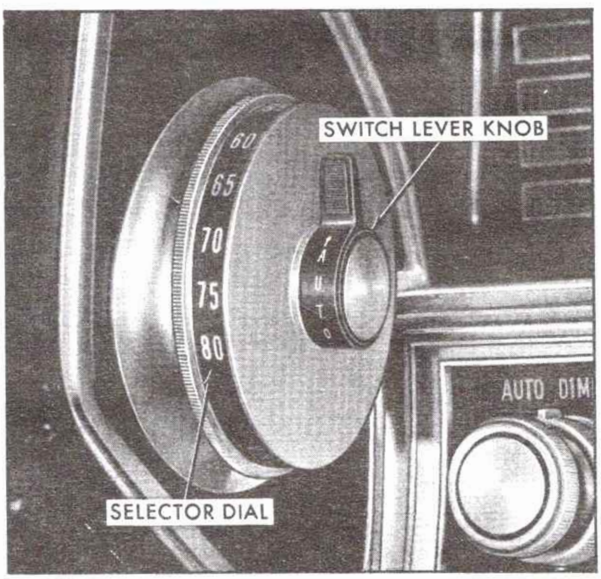


Fig. 15-9 Selector Control Assembly

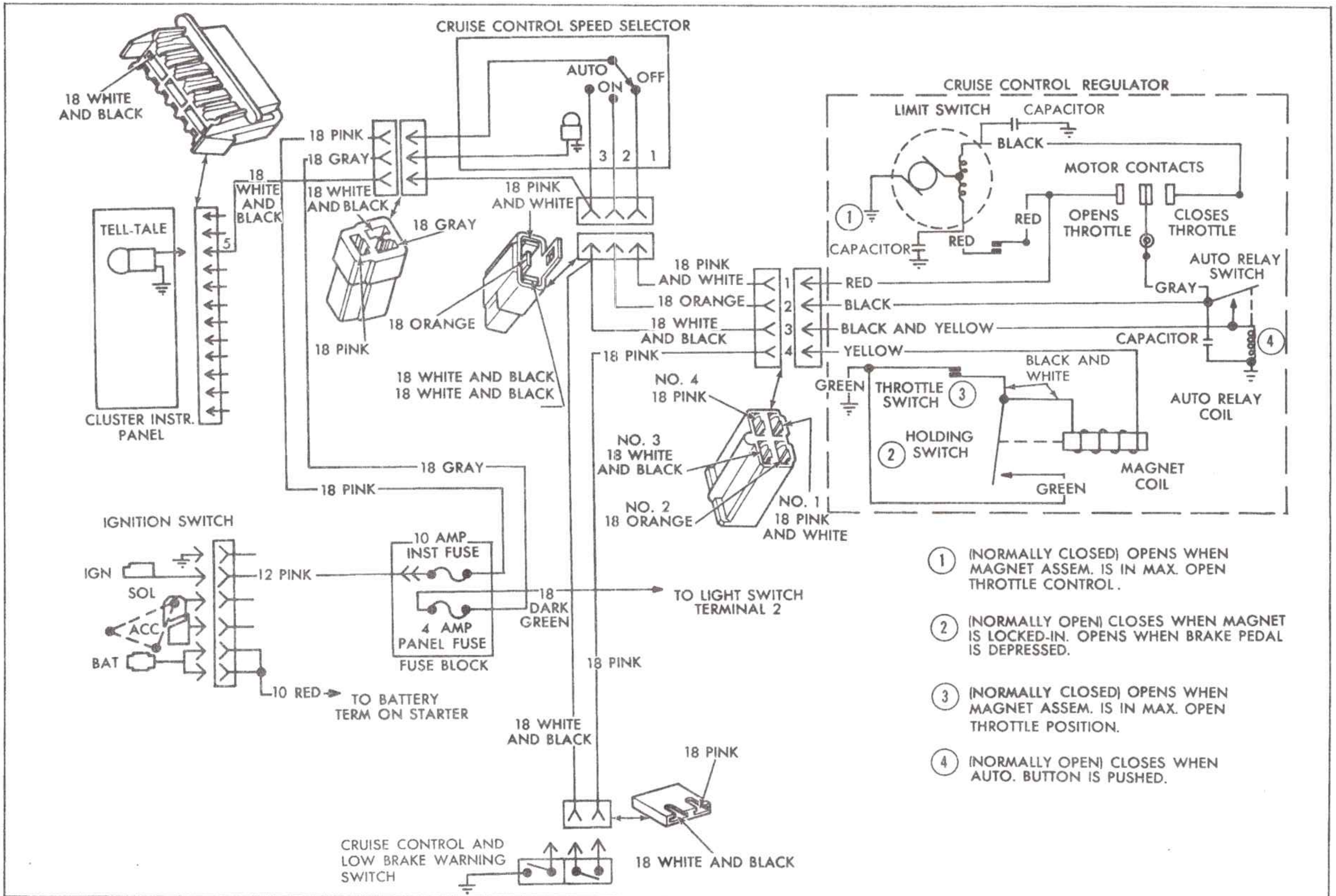


Fig. 15-10 Cruise Control Circuit Diagram

to calibrated positions, corresponding to selected speeds, by the bowden cable leading to the selector control. The complete electrical circuit for the Cruise Control is shown in Fig. 15-10.

Speed Reminder Operation

Move the switch lever to "ON" top position just to the point where spring tension is felt and rotate the selector dial to the desired speed setting, with speed setting lined up with arrow on selector control assembly. The Cruise Control will then function as a speed reminder by exerting back pressure on the accelerator pedal whenever the speed setting is reached. The unit will function in the same way whenever the speed setting is changed.

Cruise Control does not interfere with normal acceleration up to the selected speed setting. Further acceleration may be obtained above that speed by pressing the accelerator pedal past the warning back pressure position.

Automatic Speed Control Operation

For automatic speed control, move switch lever forward momentarily past spring tension to its stop, which is the AUTO position. Green indicator light marked "CRUISE" in the instrument panel will glow. Then rotate selector dial to the desired speed setting. The unit is now set for automatic control and will lock-in automatically when back pressure is felt on the accelerator at the selected speed. The car will now maintain the selected speed automatically and the driver may remove his foot from the accelerator pedal if desired. Selected speed will be maintained regardless of road terrain, within limits of engine performance.

When the unit is in automatic control, car speed can be changed by slowly rotating the selector dial forward to increase speed or rearward to decrease speed. Also, car speed can be increased at any time by pushing the accelerator pedal through the back pressure. When the accelerator is released, the car will return automatically to the selected speed.

CAUTION: When using selector dial to increase car speed during automatic control, always rotate dial slowly, to prevent sudden acceleration.

Automatic control is disengaged when the brake pedal is depressed. It can be re-engaged by simply accelerating until back pressure is felt. It is not necessary to push switch lever to AUTO position to re-engage automatic control. The AUTO setting can be cancelled by moving the switch lever to the OFF position, without touching the speed setting. This will unlock the unit and cancel speed reminder and automatic control.

Turning the ignition switch off will cancel all Cruise Control functions by stopping current flow at the ignition switch.

Turning the ignition switch off with engine running and unit in automatic control should never be done except in emergency conditions as turning the ignition switch off at 25 mph, the minimum Cruise Control setting, may cause permanent engine damage.

SERVICE INFORMATION

15. Cruise Control Preliminary Checks

It is not always necessary to remove and disassemble the power unit in cases of an inoperative Cruise Control. The following checks should be performed as part of your diagnosis to determine the cause and correction of the Cruise Control trouble and to eliminate unnecessary service work on the power unit.

1. Turn ignition switch on. Do not start engine.

2. Push slide switch to AUTO position. Green "Cruise" light (automatic indicator light) in instrument panel should light and stay lit after lever returns to ON (center position). If bulb does not light, check condition of instrument fuse in fuse panel.

3. Disconnect multiple connector at Cruise Control power unit.

4. Push switch lever to OFF position.

5. Ground one test lamp lead to terminal No. 1, Fig. 15-11. Lamp should light. If it does not light, wiring in selector control assembly or assembly is defective.

6. Ground one test lamp lead and touch other lead to terminal No. 2, Fig. 15-11, and push switch lever to ON (center) position. If lamp fails to light, check for defective wiring in selector control assembly.

7. Ground one test lamp lead and touch other lead to terminal No. 3, Fig. 15-11. Push switch lever to AUTO position and allow switch to come back to ON position. Test lamp and green indicator light should light when slide switch reaches AUTO position and then go out when slide switch returns to ON position. If test lamp fails to operate as described above, check for defective wiring in selector control assembly. Checks for indicator light will be covered later.

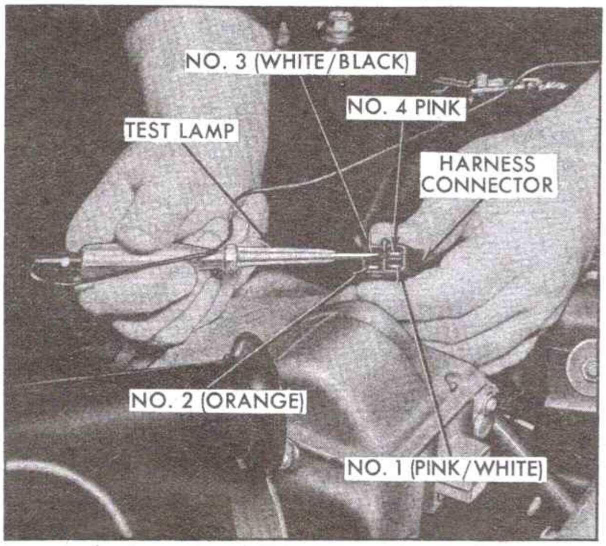


Fig. 15-11 Preliminary Electrical Checks

8. Ground one test lamp lead and touch other lead to terminal No. 4, Fig. 15-11. Push switch lever to AUTO position and manually hold switch lever in AUTO position. Depress brake pedal. Test lamp should go out and then come on when brake pedal is released. If lamp fails to operate as described above, check for improperly adjusted Cruise Control switch (see Note 20) or defective wiring in selector control assembly. Allow switch lever to return to ON position.

9. Connect multiple connector to power unit.

10. Ground one test lamp lead and touch other lead to terminal No. 3 (white with black stripe wire) at power unit. Push switch lever to AUTO position and allow switch to come back to ON position. Test lamp should light when switch lever reaches AUTO position, and remain lit when slide switch returns to ON position. If test lamp fails to operate as described above, check for loose connections at relay switch or a defective relay switch.

11. Remove test lamp and turn ignition switch off.

12. Remove four screws securing power unit cover to power unit and remove cover.

13. Turn ignition switch on and momentarily move slide switch to AUTO position to set unit for automatic control. Do not start engine.

14. Move locking arm against magnet and move contact arm against motor feed point on locking arm side of magnet. Unit should lock-in when throttle switch closes and magnet is moved to low speed position. Move slide switch to OFF position. Unit should disengage and magnet will move to wide open throttle position, opening the throttle switch.

15. If unit fails to operate as described above in step 14, check for improperly adjusted throttle switch points, defective wiring in magnet coil circuit, or a defective magnet coil.

16. Turn ignition switch off and move slide switch to OFF position.

17. Install cover on power unit and secure with four screws.

18. If green indicator light fails to glow when switch lever is moved to AUTO position, perform the following checks:

a. Check condition of indicator bulb as described in Section 12, Note 17, part a.

b. Check condition of Cruise Control automatic indicator light feed circuit as described in Section 12, Note 17, part b.

c. Check printed circuit as outlined in Section 12, Note 17, part e.

d. Check selector control assembly to see that a good contact is made at the ON terminal when switch lever is returning from AUTO to the ON (center) position.

19. If the above electrical checks fail to correct the Cruise Control trouble, check the following adjustments before removing the power unit for service work.

a. Selector dial adjustment, Note 16.

b. Selector control cable check, Note 17.

c. Accelerator linkage adjustment, Note 18.

d. Motor feed points adjustment, Note 21.

e. Limit switch and throttle switch points adjustment, Note 22.

16. Selector Dial Adjustment

1. Rotate selector dial forward to high speed position against its stop.

2. Push switch lever to ON position.

3. Operate car at a steady speed of 50 mph, as indicated on speedometer.

CAUTION: This adjustment must be performed on highway. Do not perform on hoist or jack stands in shop area.

4. Rotate selector dial rearward until back pressure is felt on accelerator pedal, then lock

in Cruise Control by momentarily pushing switch lever to AUTO position.

5. With car speed at 50 mph, as indicated on speedometer, the numeral 50 on selector dial should be lined up with arrow on selector control assembly. Observe reading on dial, then move switch lever knob to OFF position. Do not rotate selector dial.

6. If reading on selector dial agrees with reading on speedometer, selector dial is properly adjusted.

7. If readings do not agree, adjust selector dial as follows:

a. With switch lever in OFF position, rotate selector dial either forward (if dial reading is on the low side) or rearward (if dial reading is on the high side) against its stop. Then rotate dial by hand beyond its stop the necessary amount of travel as observed in step 5 to correct the selector dial setting.

b. Repeat adjustment procedure until reading on selector dial agrees with reading on speedometer.

17. Control Cable Check

1. Release retainer spring from dustshield by rotating 90 degrees and slide it back on control cable. Pull control cable to release from adjustable coupling.

2. Rotate selector dial to low speed position until it is positioned against its stop, but do not force beyond its stop.

3. Position control cable in identical position as that shown in Fig. 15-12 on all but 693 style or Fig. 15-13 on 693 style, using No. 3 slot of Control Cable Gage, J-22650. End of hook should just touch stop on gage and legs of gage should bottom on ferrule. If adjustment is more than .005" off, adjust control cable as described in Note 18.

NOTE: Control cable must be positioned as illustrated, otherwise check will not be accurate as the relationship of the inner cable to the outer cable varies according to control cable location.

4. Rotate speed selector to high speed setting and install cable into dust shield until ferrule stops against dustshield. Hold in this position and rotate retainer spring on dust shield until it is positioned into slots.

5. Rotate selector dial to low speed stop to secure control cable into adjustable coupling.

CAUTION: This step must be performed or unit will control in "ON" position or lock-in in "AUTO" position at low speed regardless of selected setting.

18. Control Cable Adjustment

NOTE: The control cable is pre-set at the factory and normally should not require adjustment unless a new cable is installed. This adjustment must be performed off car. First check control cable as described in Note 17 and, if necessary, adjust as follows:

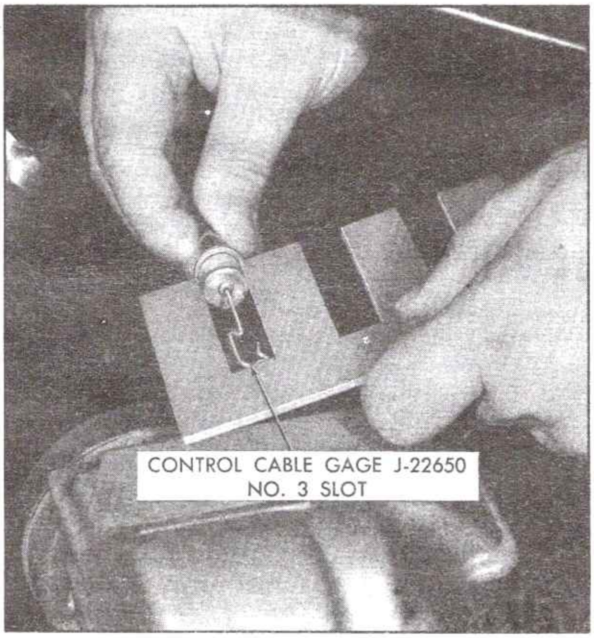


Fig. 15-12 Control Cable Check (All Except 693 Styles)

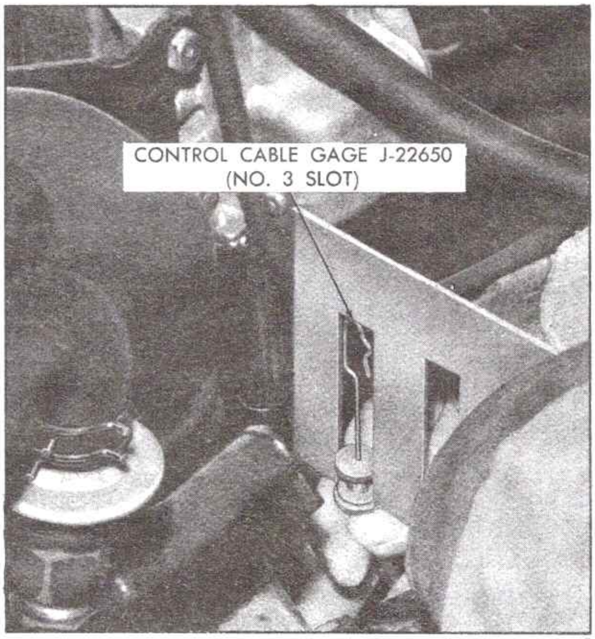


Fig. 15-13 Control Cable Check (693 Styles)

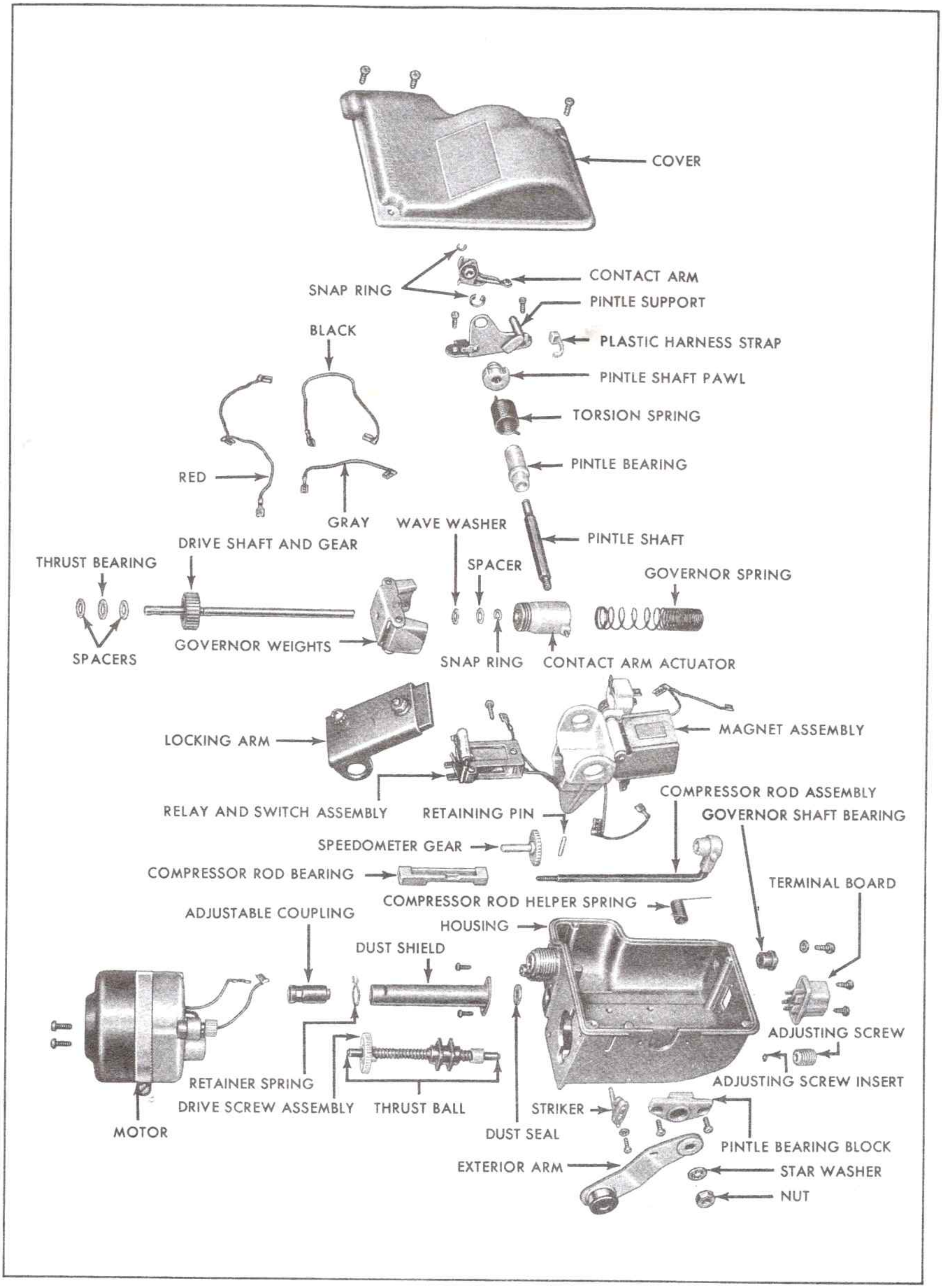


Fig. 15-21 Power Unit Disassembled

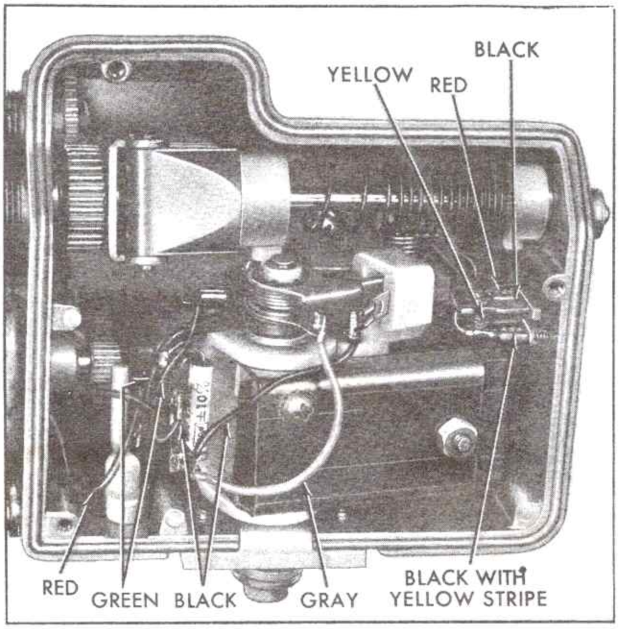


Fig. 15-22 Power Unit

8. Remove two screws securing pintle bearing block to housing and remove pintle bearing block.

9. Remove two screws holding pintle support to housing.

10. Swing assembly counterclockwise, as viewed from motor side, and free pin of contact arm actuator from contact arm.

11. Disconnect red, black, black with yellow stripe and yellow wires from terminal board and remove assembly, Fig. 15-22.

b. Magnet Assembly Disassembly

NOTE: See Fig. 15-23 when performing steps 1 - 5.

1. Disconnect green wire at lower outboard terminal of auto relay switch (capacitor side) and at pintle support.

2. Disconnect gray wire from terminal on contact arm and at upper outboard terminal of auto relay switch (capacitor side) and remove wire.

3. Disconnect black wire at upper inboard terminal of auto relay switch (capacitor side) and remove from lower slot on pintle bracket. Cut

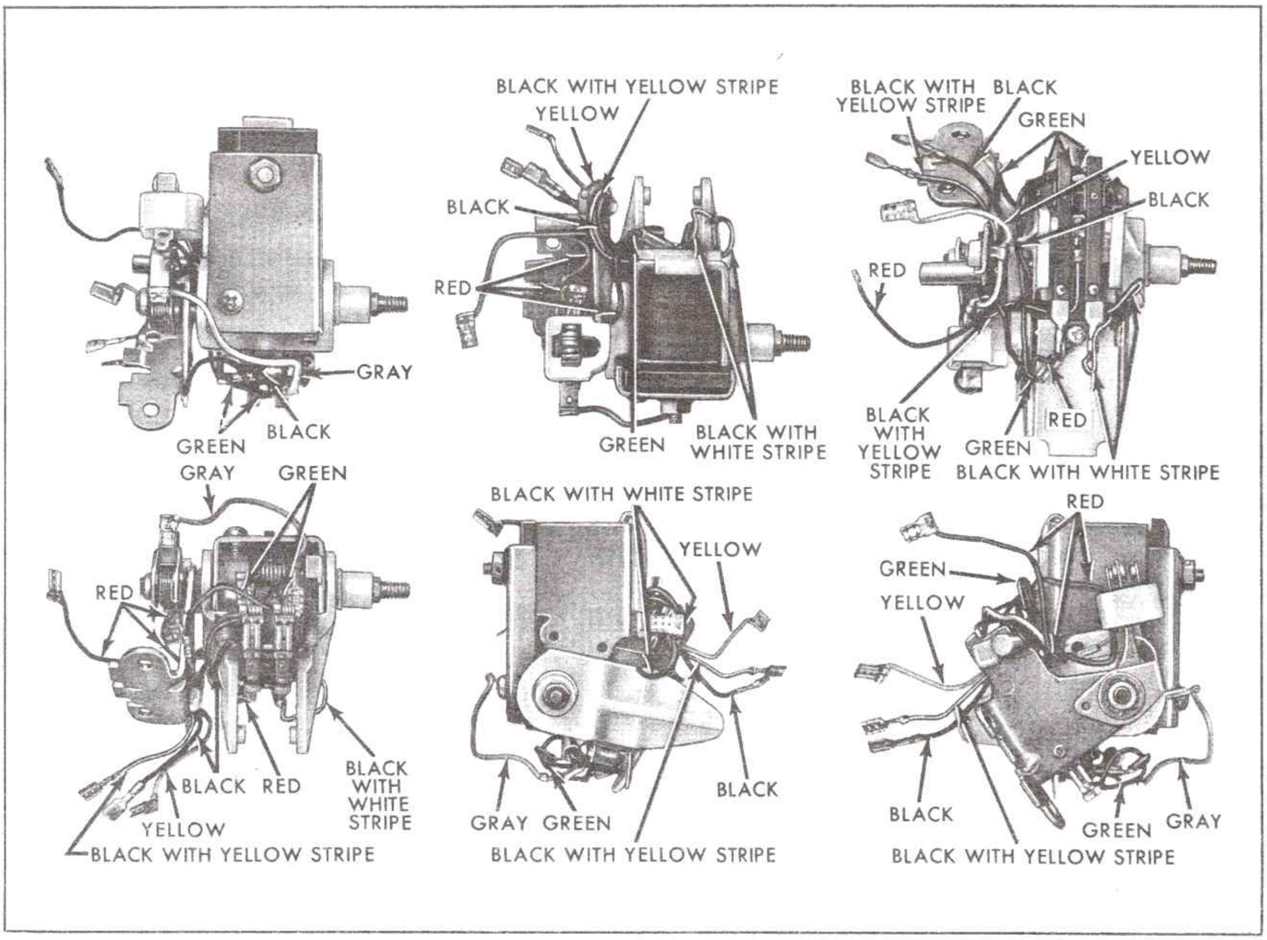


Fig. 15-23 Magnet Assembly

plastic harness strap at pintle support. Remove black wire.

4. Disconnect red wire from inboard terminal of auto relay switch (magnet side) and at open throttle motor feed point and remove wire.

5. Disconnect black with white stripe wire at outboard terminal of auto relay switch (magnet side) and at holding switch.

6. Remove screw securing auto relay switch to magnet assembly and slide auto relay switch from pintle bracket.

7. Remove small snap ring from end of pintle shaft.

8. Remove larger snap ring from pintle shaft.

9. Mount magnet assembly in a vise. Position exterior arm on pintle shaft and take up torsion spring tension, Fig. 15-24. Hold in this position and loosen screw at locking arm until screw clears pintle shaft pawl. Slowly release and then remove exterior arm.

10. Loosen set screw on pintle shaft pawl with an Allen wrench.

11. Remove pintle shaft from magnet assembly, and catch contact arm. Remove pintle support.

12. Remove pintle bearing and torsion spring from magnet assembly.

13. Remove pintle shaft pawl and locking arm from magnet assembly.

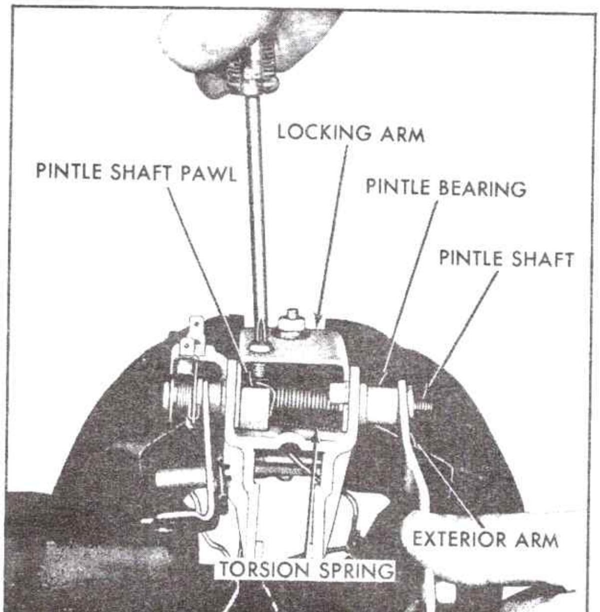


Fig. 15-24 Pawl to Screw Engagement

c. Magnet Assembly Assembly

1. Position locking arm on pintle bracket and insert pintle shaft pawl so that set screw in pawl is visible. Position torsion spring and pintle bearing, Fig. 15-25.

2. Install pintle support on pintle shaft pawl, Fig. 15-25.

3. Position contact arm between points and insert pintle shaft into assembly.

4. Install large snap ring on inner groove of pintle shaft between contact arm and pintle shaft pawl.

5. Install small snap ring on end of pintle shaft.

6. Push contact arm side of pintle shaft toward magnet assembly and tighten set screw with an Allen wrench.

7. Mount magnet assembly in a vise. Position exterior arm on pintle shaft and rotate exterior arm clockwise until screw in locking arm can engage notch in pintle shaft pawl. Tightèn screw, Fig. 15-24.

8. Slide auto relay switch on magnet assembly and secure with one screw.

NOTE: See Fig. 15-23 when performing steps 9-14. Wires must be routed exactly as illustrated.

9. Connect black with white stripe single lead at outboard terminal of auto relay switch (magnet side) and double lead at holding switch.

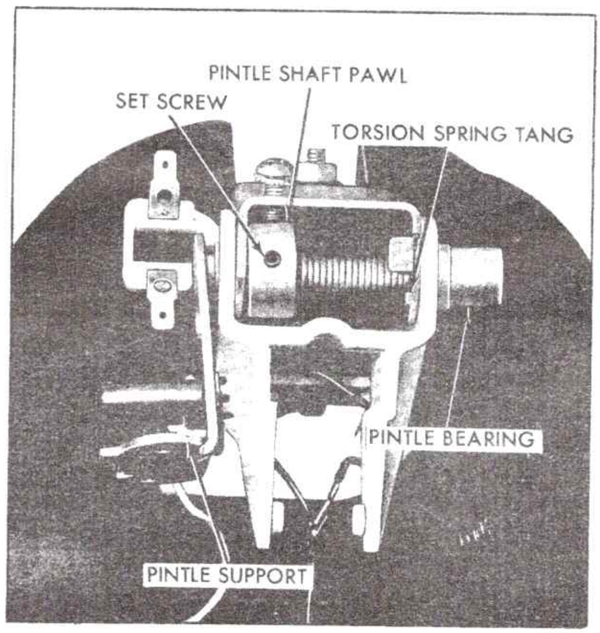


Fig. 15-25 Assembling Magnet Assembly

10. Connect long single lead red wire at inboard terminal of auto relay switch (magnet side) and connect double lead at open throttle motor feed point so that red wire is routed between pintle support and open throttle motor feed point.

11. Connect black wire at upper inboard terminal of auto relay switch (capacitor side) and position wire in lower slot on pintle bracket.

12. Position black with yellow stripe wire under red wire terminal connector. Secure black with yellow stripe, yellow and black wires at pintle support with new plastic harness strap. Position wires so there is approximately 2-1/8" extending from strap. Cut off excess strap.

13. Connect gray wire at terminal on contact arm and at upper outboard terminal of auto relay switch (capacitor side).

14. Route green wire from holding switch over red wire and black with yellow stripe, yellow and black wires and position in center slot of pintle bracket. Then route green wire over black wire and connect double lead to lower outboard terminal of auto relay switch (capacitor side) and single lead to pintle support.

d. Magnet Assembly Installation

1. Position compressor rod helper spring with shorter end positioned against tang of pintle support.

2. Install magnet assembly into housing, engaging pin of contact arm actuator with hole in contact arm. Align bracket tangs on bottom of magnet assembly with grooves in drive screw nut. Tang on pintle support must engage notch in compressor rod bearing and long end of compressor rod helper spring should be able to be pulled upward.

3. Install pintle bearing block and secure with two screws.

4. Install two screws that secure pintle support to housing.

5. Using a pair of needle nose pliers, hook compressor rod helper spring under tab on plastic compressor rod cap.

6. Install exterior arm so that when on pintle shaft, the hole in the exterior arm can be aligned with hole in housing. Secure with starwasher and nut.

7. Connect black motor wire at close throttle motor feed point routing under black wire at relay and gray wire at contact arm, Fig. 15-22.

8. Connect red motor wire at lower inboard terminal of auto relay switch (capacitor side), Fig. 15-22.

9. Connect red, black, black with yellow stripe and yellow wires at terminal board, Fig. 15-22, routing red wire under helper spring.

10. Perform limit switch and throttle switch points adjustment as outlined in Note 22.

11. Perform motor feed points adjustment as outlined in Note 21.

e. Motor Removal

1. Remove three screws that secure cover to housing and remove cover.

2. Disconnect red motor wire at lower inboard terminal of auto relay switch (capacitor side), Fig. 15-22.

3. Disconnect black motor wire at close throttle motor feed point and free wire, Fig. 15-22.

4. Remove two screws that secure motor to housing and remove motor.

f. Motor Installation

1. Position motor on housing and secure with two screws guiding red and black wires through housing. Make certain that bracket tangs on bottom of magnet assembly align with grooves in drive screw nut and drive shaft screw aligns with hole in adjusting screw and hole in motor.

NOTE: Be careful not to lose adjusting screw insert.

2. Check drive screw to see if it will turn. If not, adjust as described in step 3.

3. Turn adjusting screw until it is tight. Do not force. Then back off screw 1/4 turn.

NOTE: Do not remove adjusting screw as a normal service procedure. Repeated removal and installation of adjusting screw will ruin threads. Remove it only if it is to be replaced. A slight adjustment is all that is needed.

4. Connect black motor feed wire at close throttle motor feed point, routing under black wire at relay and gray wire at contact arm, Fig. 15-22.

5. Connect red motor feed wire at lower inboard terminal of auto relay switch (capacitor side), Fig. 15-22.

6. Install cover on housing and secure with three screws.

g. Drive Screw Assembly Removal

1. Remove three screws that secure cover to housing and remove cover.

2. Disconnect red motor wire at lower inboard terminal of auto relay switch (capacitor side), Fig. 15-22.

3. Disconnect black motor wire at close throttle motor feed point and free wire, Fig. 15-22.

4. Remove two screws that secure motor to housing and remove motor.

5. Remove drive screw assembly by tilting upward and removing from housing.

h. Drive Screw Assembly Installation

1. Lubricate drive screw assembly sparingly with cam and bearing lubricant.

2. Install drive screw in housing. Tilt screw upward at motor end and install so that bracket tangs on bottom of magnet assembly align with grooves in drive screw nut. Align drive shaft screw with hole in adjusting screw and hole in motor. Install two screws that secure motor to housing, guiding red and black wires through housing.

NOTE: Be careful not to lose adjusting screw insert.

3. Check drive screw to see if it will turn. If not, adjust as described in step 4.

4. Turn adjusting screw until it is tight. Do not force. Then back off screw 1/4 turn.

NOTE: Do not remove adjusting screw as a normal service procedure. Repeated removal and installation of adjusting screw will ruin threads. Remove it only if it is to be replaced. A slight adjustment is all that is needed.

5. Connect black motor feed wire at close throttle motor feed point routing under black wire at relay and gray wire at contact arm, Fig. 15-22.

6. Connect red motor feed wire at lower inboard terminal of auto relay switch (capacitor side), Fig. 15-22.

7. Install cover on housing and secure with three screws.

i. Governor Assembly, Removal, Disassembly and Speedometer Gear Removal

1. Remove three screws that secure cover to housing and remove cover.

2. Using a 12-volt power source, attach negative lead to housing. Manually move center contact arm to close throttle position and touch positive lead to terminal number 2 on terminal board.

NOTE: Terminal board is numbered on inside with respective terminal numbers.

3. Remove screw and flatwasher securing governor shaft bearing and remove bearing.

4. Disconnect pin on contact arm actuator from contact arm by inserting a screwdriver and carefully prying free.

5. Turn governor weights so they are parallel with sides of housing. Push weights toward governor spring until gear end of governor drive shaft and gear is free of governor shaft bushing.

6. Raise governor weights and pull governor assembly from housing.

NOTE: Do not lose two spacers and thrust bearing from gear end of governor drive shaft and gear.

7. Remove two spacers and thrust bearing.

8. Remove governor spring from governor drive shaft and gear.

NOTE: Do not stretch or damage spring.

9. Remove contact arm actuator from governor drive shaft and gear.

10. Remove snap ring, spacer and wave washer and governor weights from governor drive shaft and gear.

11. Drive out retaining pin from inside of housing and remove speedometer gear.

NOTE: Same pin will be used upon installation.

j. Speedometer Gear Installation, Governor Assembly and Installation

1. Lubricate speedometer gear with cam and bearing lubricant, and install speedometer gear in speedometer gear bushing. Retain by driving in speedometer retainer pin from outside of housing.

2. Slide governor weights, wave washer, spacer on governor drive shaft and gear and secure with snap ring.

3. Install contact arm actuator and governor spring on governor drive shaft and gear.

NOTE: Governor spring must be installed so that wide coil spacing is toward contact arm actuator.

4. Install spacer, thrust bearing and second spacer on gear end of governor drive shaft and gear.

5. With governor weights parallel with sides of housing, install governor assembly into housing by inserting spring end of governor drive shaft and gear into compressor rod plastic cap and hole in housing. Then install gear end of governor drive shaft and gear into governor shaft bushing, engaging speedometer gear.

6. Insert pin on contact arm actuator into hole in contact arm by prying against contact arm with a screwdriver.

7. Install governor shaft bearing and secure with flatwasher and screw. Flatwasher must not ride on center ridge of bearing.

8. Perform motor feed points adjustment as outlined in Note 21.

k. Compressor Rod and Dust Shield Removal

1. Remove three screws that secure cover to housing and remove cover.

2. Using a 12-volt power source, attach negative lead to housing. Manually move center contact arm to close throttle position and touch positive lead to terminal number 2 on terminal board.

NOTE: Terminal board is numbered on inside with respective terminal numbers.

3. Remove screw and flatwasher securing governor shaft bearing and remove bearing.

4. Disconnect pin on contact arm actuator from contact arm by inserting a screwdriver and carefully prying free.

5. Turn governor weights so they are parallel with sides of housing. Push weights toward governor spring until gear end of governor drive shaft and gear is free of governor shaft bushing.

6. Raise governor weights and pull governor assembly from housing.

NOTE: Do not lose two spacers and thrust bearing from gear end of governor drive shaft and gear.

7. Remove compressor rod helper spring.

8. Pull up compressor rod against its stop and measure gap between compressor rod plastic cap and housing using a feeler gage. Record measurement, Fig. 15-26.

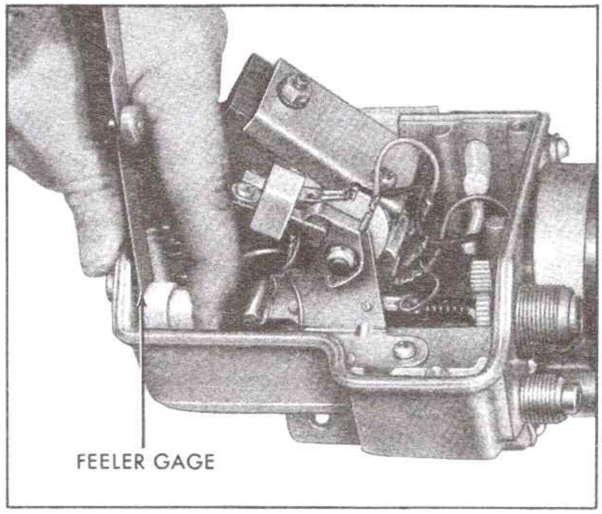


Fig. 15-26 Compressor Rod Adjustment

NOTE: This measurement is necessary for installation purposes.

9. Push compressor rod down and remove adjustable coupling with a screwdriver.

10. Remove two screws that secure dust shield to housing and remove dust shield and felt dust seal.

11. Loosen two screws that secure pintle bearing block to housing and two screws that secure pintle support to housing enough to free compressor rod bearing.

12. Remove compressor rod assembly from housing and slide off compressor rod bearing, Fig. 15-27.

l. Compressor Rod and Dust Shield Installation

1. Lubricate compressor rod with cam and bearing lubricant and slide compressor rod bearing on compressor rod with notch on inboard side, Fig. 15-27.

2. Install compressor rod in housing so that notch in compressor rod bearing is under tang on pintle support. Tighten two screws that secure pintle support to housing.

3. Tighten two screws that secure pintle bearing block to housing.

4. Position compressor rod in housing so that a portion of rod extends from housing. Install dust seal on rod so that square hole in dust seal aligns with square compressor rod, and position dust seal in housing.

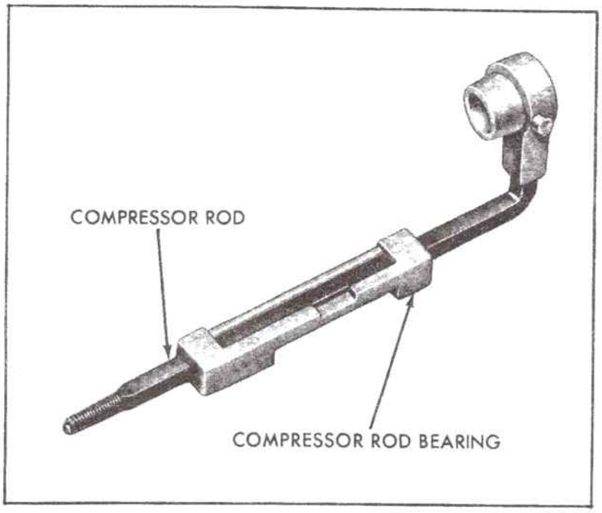


Fig. 15-27 Compressor Rod to Bearing Alignment

5. With dust seal correctly positioned, install dust shield with two screws.

6. Insert adjustable coupling into dust shield and screw onto compressor rod.

7. Using a feeler gage, position compressor rod plastic cap with same gap between housing and cap as during removal and screw adjustable coupling on rod until same gap is obtained, Fig. 15-26.

8. Install compressor rod helper spring with shorter end against tang on pintle support and hook longer end under tab on plastic compressor rod cap.

9. With governor weights parallel with sides of housing, install governor assembly into housing by inserting spring end of governor drive shaft and gear into compressor rod plastic cap and hole in housing. Then install gear end of governor drive shaft and gear into governor shaft bushing engaging speedometer gear.

10. Insert pin on contact arm actuator into hole in contact arm by prying against contact arm with a screwdriver.

11. Install governor shaft bearing and secure with flatwasher and screw. Flatwasher must not ride on center ridge of bearing.

12. Perform motor feed points adjustment as outlined in Note 21.

13. Perform limit and throttle switch points adjustment as described in Note 22.

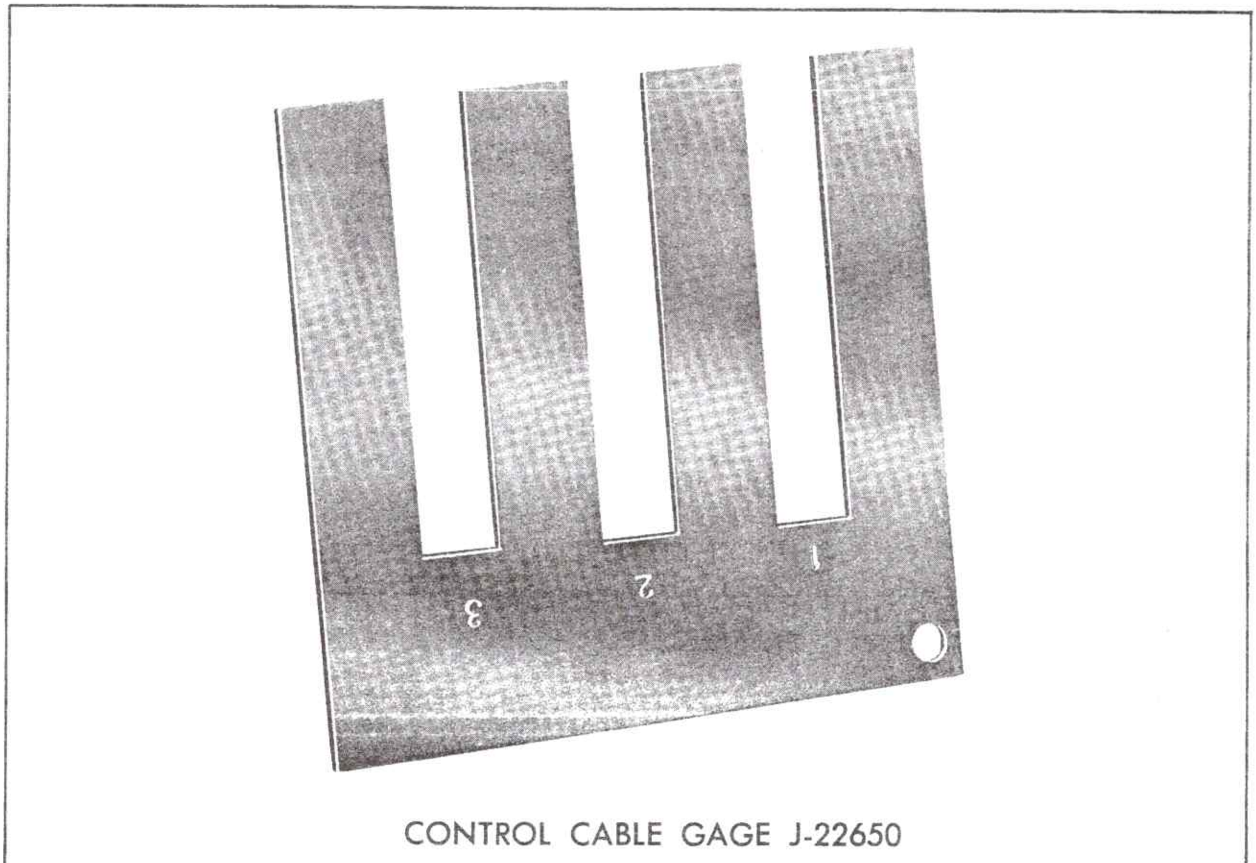


Fig. 15-28 Special Tool - Cruise Control

CRUISE CONTROL DIAGNOSIS CHART

CONDITION	CAUSE	REMEDY
Speedometer noise	Cables bent or kinked.	Straighten or replace cables. See Note 25.
	Lack of cable lubrication.	Lubricate.
	Noisy speedometer head assembly.	Repair.
Blowing fuses	Short or ground in wiring circuit.	Perform electrical checks. See Note 15.
	Defective motor.	Check operation of motor. See Notes 23 and 24.
	Locked drive screw.	Check drive screw for binding. See Note 23.
No Cruise Control response	Accelerator linkage broken or disconnected.	Connect or replace linkage and adjust, see Note 19.
	Drive cables broken or disconnected.	Connect or replace cables. See Note 25.
	Blown fuse.	Perform electrical checks. See Note 15.
	Loose connections or broken wires (internal or external).	Perform electrical checks. See Note 15.
No Automatic Control when unit is set for automatic lock-in	Driver riding the brake pedal or driver does not accelerate to selected speed.	Instruct owner.
	No current at #2 terminal.	Perform electrical checks. See Note 15.
	Improper throttle switch adjustment.	Adjust limit and throttle switch. See Note 22.
	Improper Cruise Control switch adjustment.	Adjust Cruise Control switch. See Note 20.
Constant pressure on accelerator pedal regardless of dial setting.	Blown fuse.	Perform electrical checks. See Note 15.
	No current at #1 terminal.	Perform electrical checks. See Note 15.
	Control cable improperly adjusted.	Adjust control cable. See Note 18.
	Control cable defective.	Replace selector control cable.

CRUISE CONTROL DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Constant pressure on accelerator pedal regardless of dial setting. (Cont'd.)	Inoperative motor or locked drive screw.	Check operation of motor and/or drive screw. See Note 23.
	Improper limit switch adjustment.	Adjust limit switch and throttle switch. See Note 22.
Automatic control engages at selected speed without unit set for automatic lock-in.	Shorted automatic relay switch (green indicator light on instrument panel will be on).	Perform electrical checks. See Note 15.
Automatic control remains engaged when brake pedal is depressed.	Improper Cruise Control switch adjustment or defective switch.	Adjust Cruise Control switch. See Note 20.
Unit remains operative in the "OFF" position.	Limit switch not properly adjusted.	Adjust limit switch and throttle switch. See Note 22.
Pulsating accelerator pedal.	Speedometer cable or drive cable kinked or lack of lubrication.	Lubricate or replace cables if necessary. See Note 25.
	Improper accelerator linkage adjustment.	Adjust accelerator linkage. See Note 19.
	Improper motor feed points adjustment.	Adjust motor feed points. See Note 21.
Carburetor does not return to normal idle.	Improper carburetor or accelerator linkage adjustment.	Adjust throttle control rod and accelerator linkage. See Note 19.
	Weak or disconnected throttle return spring.	Connect or replace spring.
Unit does not control at selected speed.	Improper control cable adjustment.	Adjust control cable. See Note 18.
	Improper selector dial adjustment.	Adjust selector dial. See Note 16.
	Improper accelerator linkage adjustment.	Adjust accelerator linkage. See Note 19.
Unit controls in "ON" position or locks in "AUTO" position at low speed regardless of selected setting.	Control cable not secured to adjustable coupling.	Rotate selector dial to low speed stop to secure.

CRUISE CONTROL DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Speedometer does not register.	Speedometer drive gear in transmission defective.	Replace gear.
	Broken drive cable from transmission to power unit.	Replace driven cable.
	Damaged drive gear or nylon gear in power unit.	Replace nylon gear or drive shaft and gear assembly.
	Broken speedometer cable.	Replace speedometer cable.

GENERAL DESCRIPTION

GUIDE-MATIC

The Guide-Matic is a transistorized electronic device that automatically controls the upper and lower beams of the car headlights in response to light from an approaching car. It is available as optional equipment on all 1967 Cadillac cars.

The Guide-Matic consists of five major components: a photo-amplifier unit, a power relay, a foot switch, a sensitivity control, and an interconnecting wire harness, Fig. 15-29.

The photo-amplifier unit combines a light sensing optical device and electronic amplifier into one unit with sufficient power to operate a power relay for switching headlight beams.

The unit is mounted on the left front side of the radiator cradle assembly on all but the Fleetwood Eldorado. On these cars the unit is mounted below the tie bar just to the left of center of the car.

Light from approaching headlights is picked up by the lens. A level assembly for use in setting correct vertical aim is attached as part of the unit. A serial number label is attached to the underside of the unit. The unit is adjusted for sensitivity at the factory and then completely sealed by filling the interior of the metal case with a moistureproof epoxy material. The epoxy forms a capsule around all the interior parts and prohibits access to factory sensitivity adjustments or other interior parts. If a failure occurs, service by replacement.

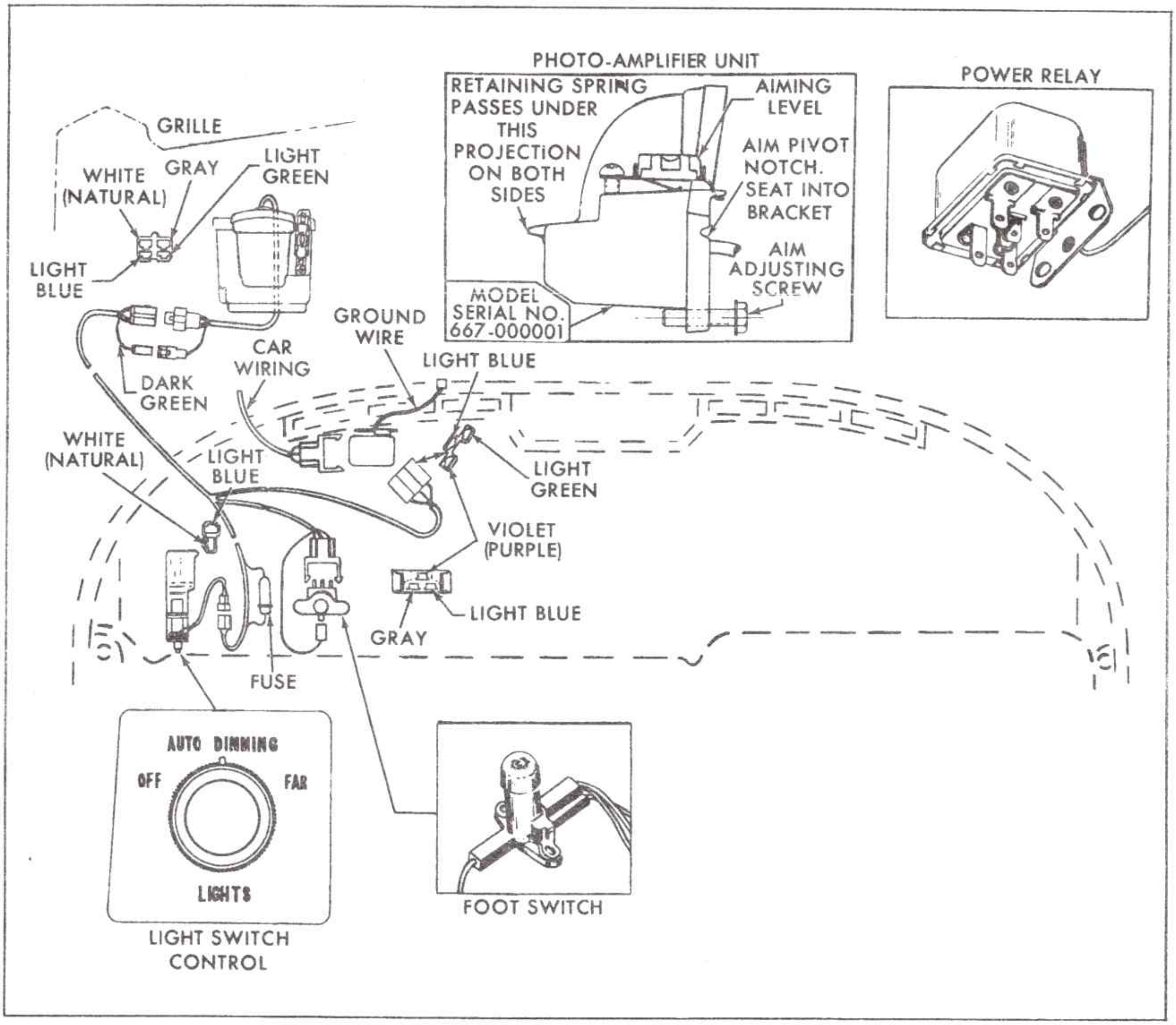


Fig. 15-29 Guide-Matic Components

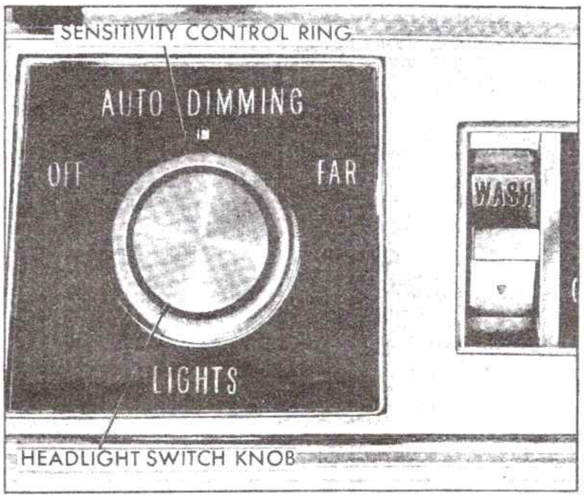


Fig. 15-30 Sensitivity Control Ring

The power relay switches the headlight beams in response to the signal from the photo-amplifier unit. It is mounted on the dash insulator just to the right of the parking brake assembly.

The foot switch is a special dimmer-override type that provides either "automatic" or "lower beam" control of the headlights. It also contains an override section for obtaining an overriding high beam when in "automatic" low beam position, if required.

The override section functions as follows: with the foot switch in "Automatic" position, a slight downward pressure on top of the switch provides upper beam regardless of the amount of light on the photo-amplifier unit. This arrangement permits signaling an approaching driver if he fails to switch to lower beam and also provides a simple test for finding "automatic" position of the foot switch.

The sensitivity control ring (driver control), Fig. 15-30, is located directly behind and is concentric with the headlight switch knob. This gives the car driver a limited range of control over Dim and Hold sensitivity. Centering the control ring pointer between the words Off and Far provides normal sensitivity.

Rotating the ring pointer clockwise toward the word Far increases sensitivity and headlights will switch to lower beam when an approaching car is farther away. Rotating the ring pointer counterclockwise toward the word Off decreases sensitivity, thus allowing an approaching car to come nearer before switching occurs. For additional function of the control ring, see Operation – Manual.

Operation—Automatic

When the light from an approaching car's headlights strikes the photo-amplifier unit, the lens focuses it onto the light sensitive surface of a photocell. When the light on the photocell reaches a predetermined level, the amplifier section triggers (pulls on) the power relay, causing it to switch (Dim) the headlights from upper beam to lower beam. If the approaching car's headlights are then switched to lower beam, the amount of light striking the photo-amplifier unit is reduced. However, the Guide-Matic is designed to "hold" the headlights on lower beam with this reduction.

If driver desires his lights to switch when approaching car is farther away or nearer he may adjust the driver control pointer to suit his desire. Also if approaching driver fails to dim, he may signal him by momentarily "overriding" his headlights back to upper beam by putting a slight downward pressure on top of the foot switch. When he removes the pressure his headlights will revert to lower beam if sufficient light ahead remains.

When the approaching car passes and its lights no longer reach the photo-amplifier unit, the amplifier removes the signal from the power relay causing it to "drop out" and switch the headlights back to upper beam.

Operation—Manual

The Guide-Matic unit can be switched to manual operation by rotating the driver control ring counterclockwise until pointer is in Off position as indicated on the left side of the lens. In this position the photocell is desensitized to the point where the unit will provide only upper beam when the foot switch is in "automatic" position.

When the Guide-Matic is placed in manual operation, the foot switch operates like a conventional dimmer switch, switching headlights alternately between upper and lower beams.

Operation—Lower Beam

When the foot switch is placed in "lower beam" position, the Guide-Matic is disconnected and headlights will remain on lower beam until foot switch is changed to "automatic" position.

The electrical circuit for Guide-Matic is shown in Fig. 15-31.

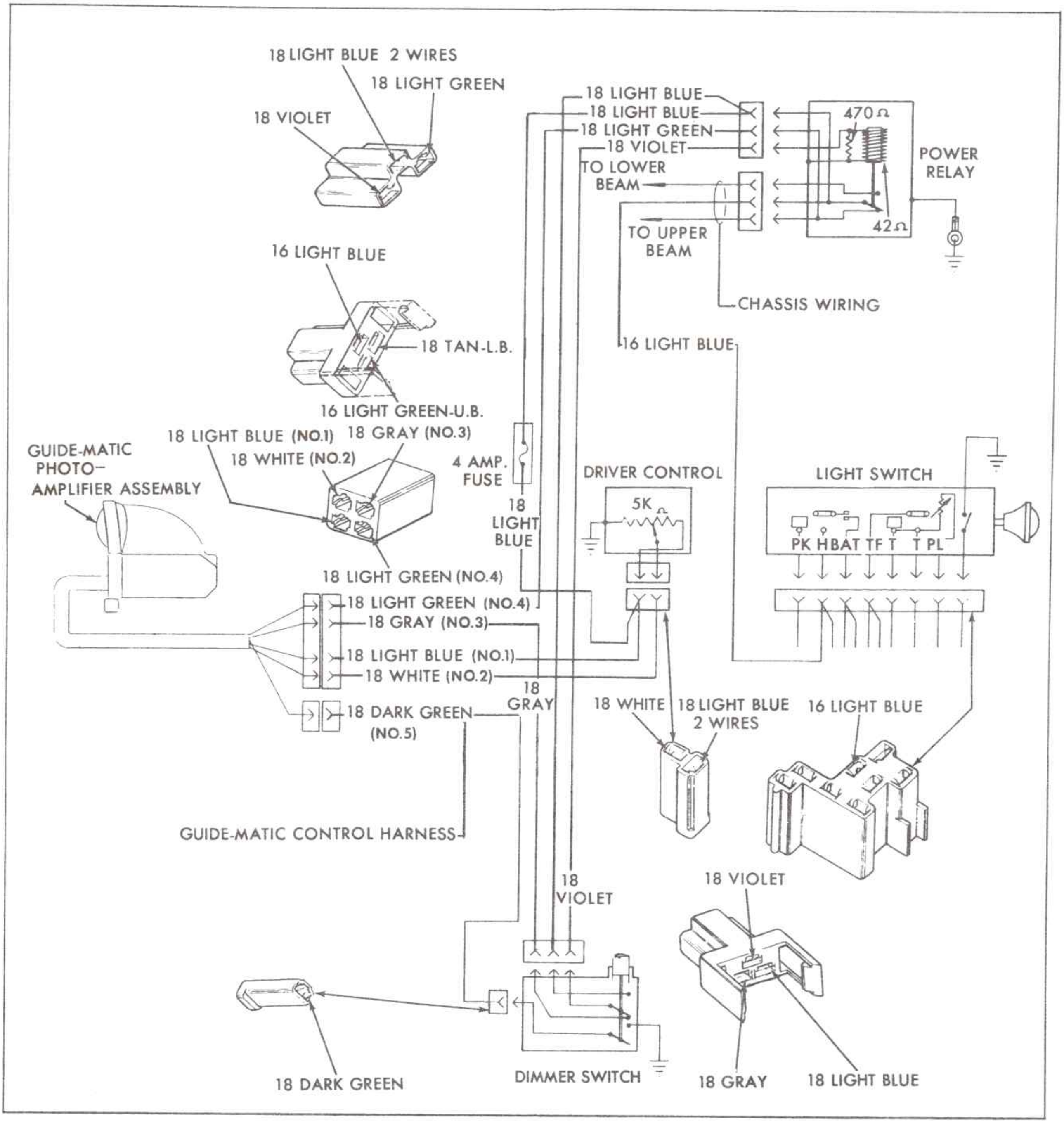


Fig. 15-31 Guide-Matic Circuit Diagram

SERVICE INFORMATION

30. Preliminary Checks

If trouble is reported, the condition will generally be one of the following:

1. Headlights switch to lower beam when an approaching car is too near or too far away.

2. Headlights will not switch to lower beam automatically.

3. Headlights will not return to upper beam when no car or other lights are ahead.

4. Headlights return to upper beam when approaching car switches to lower beam.

5. Headlights switch rapidly back and forth between upper and lower beam.

The following checks should be performed in

sequence during diagnosis to determine the cause and correction of Guide-Matic trouble and to eliminate unnecessary service work.

NOTE: This transistorized Guide-Matic does not require a warm-up time.

With car in a lighted area, check as follows:

1. Check position of driver control ring. If pointer is rotated counterclockwise to the "off" position, check with the owner to be sure he understands operation of the unit.

2. Operate engine at fast idle.

3. Set driver control ring pointer at approximate center of its travel.

4. Turn light switch on. Headlights should remain on lower beam in both positions of foot switch. If so, proceed to step 5. If not, perform the following checks:

a. Check for loose connection at 4-way connector near photo-amplifier, Fig. 15-31.

b. Disconnect photo-amplifier from nearby single connector (18 dark green terminal 5 shown in Fig. 15-31). If lower beam is obtained in both positions of foot switch, see Fig. 15-31 and check for shorted 18 dark green wire or shorted override section of foot switch. To check foot switch, reconnect single connector near photo-amplifier. Now disconnect 18 dark green wire from foot switch. If lower beam is obtained in both positions of foot switch, replace foot switch.

c. Disconnect photo-amplifier from nearby 4-way multiple connector in interconnecting cable. Connect Guide-Matic Analyzer, J-21529, as shown in Fig. 15-32. (Do not connect red positive +13 volt DC in lead to battery.) Touch voltage output lead to terminal 1 in multiple connector (18 light blue). Analyzer voltmeter should read full scale. If not, see Fig. 15-31 and check for blown 4-amp fuse (near driver control connector), loose connection at driver control connector or power relay.

d. Leave analyzer connected as shown in Fig. 15-32. Connect voltage output lead to terminal 2 (18 white) in multiple connector. Rotating driver control ring should vary meter voltage reading from 0 volts to full scale. If not, see Fig. 15-31 and check for loose connection at driver control 2-way connector, poor ground at driver control or defective driver control.

e. Leave analyzer connected as shown in Fig. 15-32. Now touch voltage output lead to terminal 4 (18 light green) in multiple connector. Analyzer voltmeter should read full scale. If not, see Fig. 15-31, and check for loose connection at power relay.

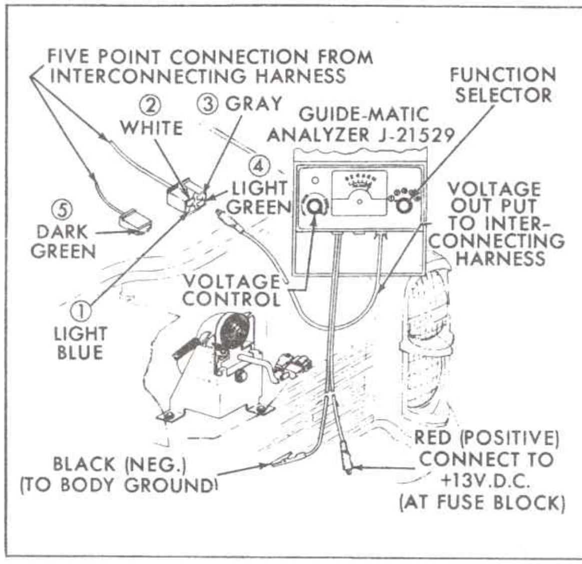


Fig. 15-32 Circuit Check-Out from Connector

f. Connect analyzer + and - 13 volt DC in leads to car battery. Connect voltage output lead to terminal 3 (18 gray). With function selector switch in position #1, rotate voltage control knob fully clockwise. Headlights should be on lower beam in both positions of foot switch. If not, see Fig. 15-31, and check for loose connections at foot switch or power relay and poor power relay ground.

g. Check for defective power relay. To check, connect analyzer, J-21529, as shown in Fig. 15-33. Lights should switch to lower beam with voltage control knob at maximum clockwise position and function selector switch in position #1. If not, replace power relay.

h. Check for defective foot switch. To check, connect Analyzer, J-21529, as shown in Fig.

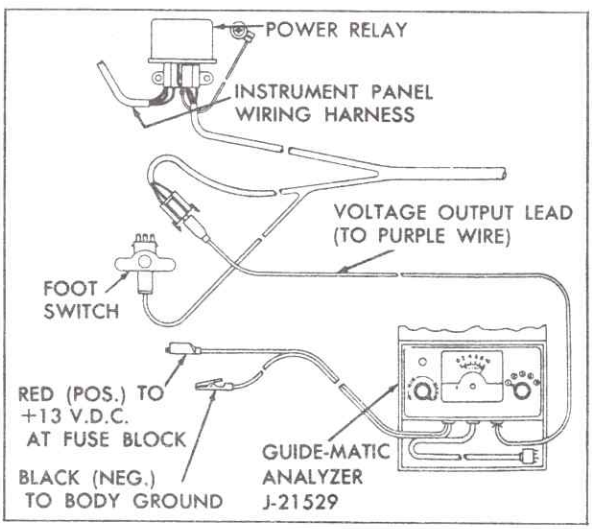


Fig. 15-33 Power Relay Check

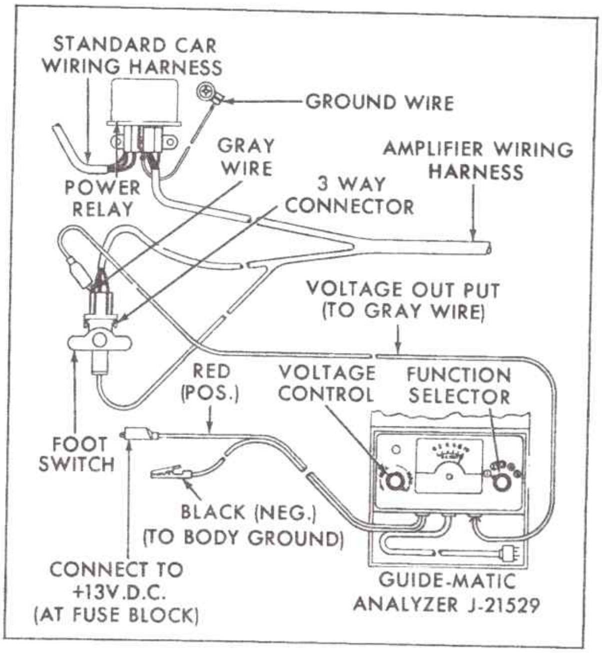


Fig. 15-34 Foot Switch Check

15-34. Lights should remain on lower beam in both positions of foot switch with voltage control knob at maximum clockwise position and function selector switch in position #1. If not, replace foot switch.

i. If problem was not found in steps 4a through 4h, the photo-amplifier is defective. Replace photo-amplifier.

5. Place foot switch in automatic position and depress foot switch slightly. Headlights should switch to upper beam. If so, proceed to step 6. If not, perform the following checks:

a. Check for disconnected dark green wire at foot switch.

b. Disconnect dark green wire from foot switch and ground to car body. If upper beam is obtained, replace defective foot switch. If not, check continuity of dark green wire to single connector near photo-amplifier unit, Fig. 15-31.

c. If lights still fail to switch to upper beam, replace defective photo-amplifier.

6. Place foot switch in automatic position and cover outer plastic lens opening on front of photo-amplifier with a black cloth. Headlights should switch to upper beam. When cloth is removed, headlights should switch to lower beam. If so, proceed to step 7. If not, perform the following check:

a. Disconnect photo-amplifier at nearby 4-way connector. If headlights switch to upper beam, replace defective photo-amplifier.

7. With headlights on lower beam, rotate driver control ring pointer counterclockwise to "off" position. Headlights should switch to upper beam. If so, proceed to step 8. If not, see Fig. 15-31, and check driver control for defective connection to ground.

8. If Guide-Matic responded to the above steps 4 through 7 without failure, perform the following steps:

a. Check vertical aim as described in Note 31.

b. Check Dim and Hold sensitivity as described in Note 32.

31. Vertical Aiming Adjustment

Accurate vertical aim is essential to proper performance of the Guide-Matic. If the phototube unit is aimed too low, reflected road light from the car's own headlights can cause the Guide-Matic to hold the headlights on lower beam. The unit must be aimed as low as possible, however, to provide maximum tolerance for car loading.

NOTE: The aiming procedure outlined here should be rechecked on new cars that have been driven 2,000 miles.

1. Photo-amplifier vertical aiming should be performed with car unloaded, trunk empty except for spare tire, gas tank at least half full and tires at correct pressure.

2. Locate car on a level floor (level within 1/4 inch fore and aft).

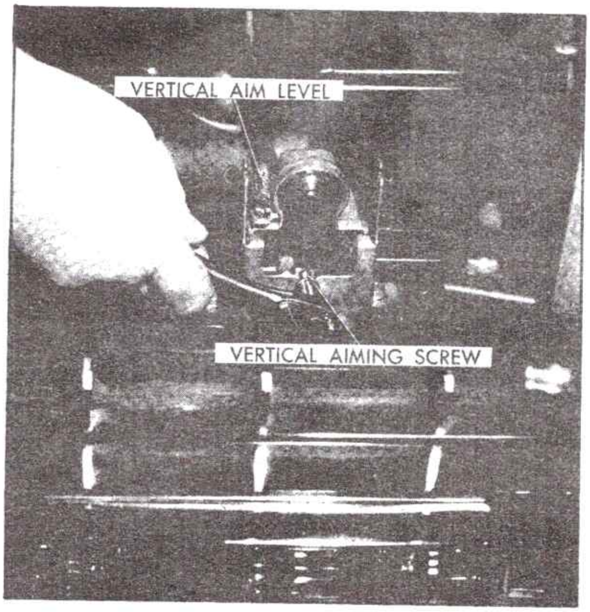


Fig. 15-35 Vertical Aim Adjustment

3. Rock car sideways or up and down to equalize springs.

4. Raise car hood.

5. Adjust vertical aiming screw on phototube unit until bubble is centered in level, Fig. 15-35.

NOTE: Always make final adjustment while turning screw clockwise.

32. Dim and Hold Sensitivity Test on Car

The individual sensitivity controls for Dim and Hold are located in the photo-amplifier and are adjusted and sealed at the factory so they are not accessible in the field. Our sensitivity check is only to determine if the driver control can be adjusted to provide the driver at least a minimum acceptable dimming sensitivity (switch to lower beam) and at the same time provide an acceptable hold sensitivity (point of return to upper beam).

1. Preparation for Test

a. Use Guide-Matic Analyzer, J-21529, with Guide-Matic Analyzer Adapter, J-22622. Since an individual test bulb is no longer incorporated in each photo-amplifier, it is necessary to adapt the present analyzer test bulb assembly (previously designed for use with the Twilight Sentinel) to supply a calibrated light source. A dome-shaped filter is glued into the adapter to reduce light to a level consistent with Guide-Matic sensitivity. The test bulb assembly plugs into the rear of the adapter head. If bulb burns out, replace with a #53 bulb. Make sure filament of bulb is standing fairly straight up so that a minimum of the side of the filament is exposed to the end of the bulb. The end of the bulb should be approximately flush with the end of its rubber sleeve.

b. Install analyzer test bulb assembly into smaller diameter hole in rear of adapter head. Push bulb and rubber sleeve forward until they stop against inner bulkhead wall of adapter head, Fig. 15-36.

c. Install and connect analyzer as shown in Fig. 15-36. Be sure adapter is seated snug around lens and bail is snapped tightly into position. On the 693 style it will be necessary to remove two screws securing photo-amplifier shield, mount adapter and install shield. Do not disconnect electrical connectors.

d. Cover photo-amplifier with black cloth to eliminate outside light.

e. Rotate analyzer function selector switch to #1 position.

f. Rotate driver control ring pointer counterclockwise to "off" position.

g. Turn on headlights and operate engine at fast idle.

2. Test Procedure

a. Adjust analyzer voltage control knob until meter reads 7.0 volts.

b. Slowly rotate driver control ring clockwise just to point where headlights switch to lower beam.

c. Check accuracy of driver control adjustment by rotating analyzer voltage control knob counterclockwise until headlights switch to upper beam. Then slowly rotate analyzer voltage control knob clockwise until headlights switch to lower beam. Voltmeter should read between 6.5 and 7.0 volts.

d. If reading does not agree, repeat steps a, b, and c.

e. Rotate analyzer voltage control knob counterclockwise to a reading that is one volt less than reading obtained for switching to lower beam in Step c. Wait four seconds and headlights should not switch to upper beam. Rotate analyzer voltage control knob counterclockwise to a reading that is 2.5 volts less than reading obtained for switching to lower beam in Step c. Headlights should switch to upper beam within four seconds.

f. If this minimum dim and hold sensitivity can be obtained at any position of the driver control ring, the unit is acceptable for sensitivity and you may proceed to step g. If Dim (switching to lower beam) sensitivity cannot be adjusted (step

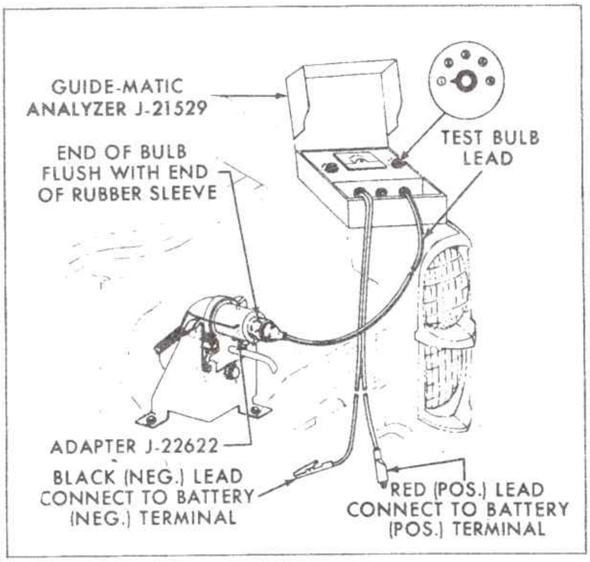


Fig. 15-36 Dim and Hold Sensitivity Test

b), replace defective photo-amplifier. If dim and hold sensitivity readings are close together on the analyzer voltmeter (approximately 1/3 to 3/4 volt) see Fig. 15-31 and check for open 18 light green wire between power relay and 4-way connector near photo-amplifier. Follow procedure outlined under 4e of Preliminary Checks. If all right, replace photo-amplifier.

g. Turn off engine, disconnect analyzer, reconnect any wires previously disconnected, and remove black cloth from photo-amplifier. On 693 style, perform vertical aim adjustment as described in Note 31.

33. Sensitivity Control Switch

The procedure for removing and installing the Guide-Matic sensitivity control switch is described in Section 12, Note 46.

34. Photo-Amplifier Unit

a. Removal

1. Disconnect negative battery cable at battery.

2. Disconnect four-way and one-way electrical connectors near photo-amplifier.

CAUTION: Do not pull on cable sheathing, otherwise leads could be damaged.

3. Remove screw securing photo-amplifier unit to mounting bracket and release retaining spring.

4. Carefully remove photo-amplifier unit from mounting bracket.

b. Installation

1. Connect retaining spring to photo-amplifier unit.

2. Install photo-amplifier unit on mounting bracket and secure with screw.

3. Connect four-way and one-way electrical connector near photo-amplifier.

CAUTION: Make sure connectors are firmly installed.

4. Connect negative battery cable at battery.

5. Adjust vertical aim as described in Note 31.

35. Power Relay Unit

a. Removal

1. Disconnect negative battery cable at battery.

2. Disconnect two three-way electrical connectors from power relay unit.

3. Loosen ground wire retainer screw on toe pan and remove ground wire.

4. Remove two screws that hold power relay unit to dash insulator and remove power relay unit from dash insulator.

b. Installation

1. Position power relay unit against dash insulator and secure with two screws.

2. Install ground wire under retainer screw on toe pan and tighten screw securely.

3. Connect two three-way connectors to power relay unit.

4. Connect negative battery cable to battery.

36. Foot Switch

a. Removal

1. Disconnect negative battery cable at battery.

2. Remove left side kick pad.

3. Remove rubber boot from foot switch.

4. Partially raise floor carpet to gain access to foot switch.

5. Disconnect one-way and three-way electrical connectors at foot switch.

6. Remove two screws that hold foot switch to floor pan and remove foot switch.

b. Installation

1. Install foot switch on floor pan and secure with two attaching screws.

2. Connect one-way and three-way connectors to foot switch.

3. Reposition floor carpet and install left side kick pad.

4. Install rubber boot on foot switch.

5. Connect negative battery cable to battery.

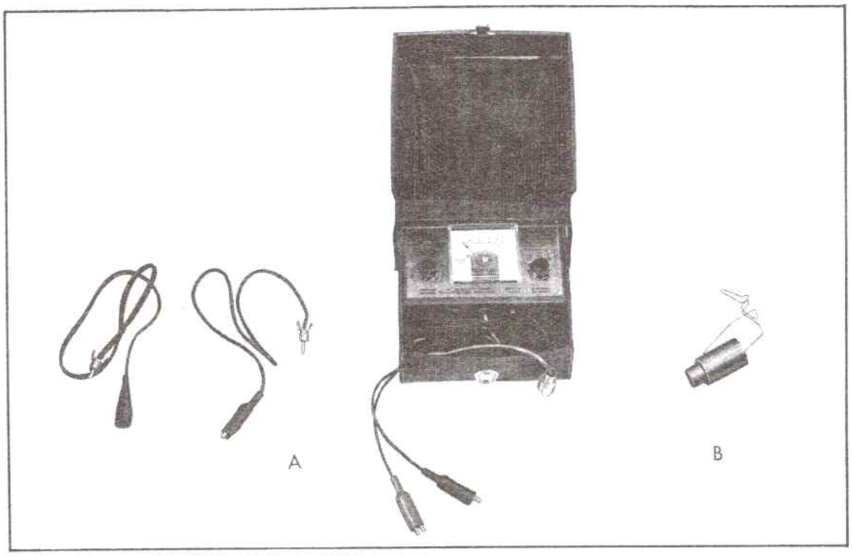


Fig. 15-37 Special Tools - Guide-Matic

Key	Tool No.	Name
A	J-21529	Guide-Matic Analyzer
B	J-22622	Guide-Matic Analyzer Adapter

GUIDE MATIC TROUBLE DIAGNOSIS

- Headlights Switch to Low Beam when an approaching Car is too close, or will not Switch to Lower Beam at all.
  - Check Position of Sensitivity Control Ring. If Ring is in Off Position, Headlight will not Switch to Low Beam in the Automatic Position. If Control Ring is near Off, Headlights will not Switch to Low Beam until Car is close.
    - Control at or Near Off Position. Explain operation of system to owner.
    - Control Ring Not at Fault
      - Check Vertical Aim Adjustment
        - Vertical Aim Incorrect. Perform adjustment as described in Note 31.
        - Vertical Aim Correct
          - Perform preliminary checks as described in Note 30.

- Headlights Switch to Lower Beam when an approaching Car is too far away.
  - Check Position of Sensitivity Control Ring. If Ring is at or near far position, Headlights will Switch to Lower Beam when approaching Car is farther away.
    - Control Ring at or near Far Position. Explain operation of System to Owner.
    - Control Ring Not at Fault
      - Perform preliminary checks as described in Note 30.
        - Headlights return to Upper Beam when approaching Car Switches to Lower Beam.
          - Check Vertical Aim Adjustment
            - Vertical Aim Incorrect. Perform adjustment as described in Note 31.
            - Vertical Aim Correct
              - Perform preliminary checks as described in Note 30.
                - Headlights Switch Rapidly back and forth between Upper and Lower Beam.
                  - Perform preliminary checks as described in Note 30.

- Headlights will not Return to Upper Beam when no Car or other Lights are ahead.
  - Driver may have Depressed Foot Switch so that Car is in Manual Low Beam. To Check turn Headlights on and Depress Foot Switch half way, if Bright Lights do not light system is in Manual Low Beam.
    - System in Manual Low Beam Explain Operation of System to Owner
    - System Not in Manual Low Beam
      - Check Vertical Aim Adjustment
        - Vertical Aim Incorrect. Perform Adjustment as described in Note 31.
        - Vertical Aim Correct
          - Perform preliminary checks as described in Note 30.
    - Unable to Determine if System in Manual Low Beam. Override Action Cannot be Determined in Either Position of Foot Switch.
      - Perform preliminary checks as described in Note 30.

GENERAL DESCRIPTION

TWILIGHT SENTINEL

The Twilight Sentinel (available as optional equipment) is an electronic device that automatically controls the on-off operation of the headlights, taillights, and instrument lights of the car on which it is installed. A time delay turn-off control permits the car lights to remain on if desired, for a pre-selected period of time after the ignition switch is turned off. The complete system consists of three units: a photocell unit, an amplifier unit, and a variable time delay turn-off and master on-off control, Fig. 15-38.

The photocell unit is the light sensing device and is mounted with the sensing surface facing upward so it is exposed to direct outside light through the windshield. Mounting location, on cars equipped with stereo, is on the underside of the small speaker grille in the left end of the upper instrument panel cover. Mounting location, on cars without stereo, is on the underside of the regular front speaker grille in the upper instrument panel, Fig. 15-38. Light strikes the sensing surface through an opening in the speaker grille. The internal resistance of the photocell varies according to amount of light striking the sensing surface. As the amount of light is reduced, the internal resistance of the photocell increases until finally it actuates the amplifier to turn the lights on.

The amplifier unit, which consists of a transistor amplifier, sensitive relay, power relay, and transistor turn-off time delay, switches the car lights on or off in response to signals from the photocell. The amplifier is located just to the left of the glove box opening.

The time delay turn-off control ring, Fig. 15-39, is located directly behind and is concentric with the standard headlight switch knob. This ring controls the time delay turn-off feature and also operates the manual-automatic switch. The electrical circuit for the Twilight Sentinel is shown in Fig. 15-40.

Operation—Automatic

With the time delay turn-off control ring pointer in ON position (anywhere counterclockwise of OFF), ignition switch turned on, and headlight switch off, the Twilight Sentinel provides completely automatic on-off operation off the car lights. As daylight reduces to the point where lights are needed for illumination, the Twilight Sentinel will automatically turn the car lights on.

The time delay circuit in the amplifier, which reduces the possibility of lights turning on when passing under viaducts, trees, etc., or turning off when passing under bright lights, has been revised this year to increase the time delay from the previous three to six seconds to a nominal fifteen to thirty seconds. In some sets the maximum time delay could be as high as sixty seconds.

The variable time delay turn-off control permits the car lights to remain on for a pre-selected period after the ignition is turned off. The driver may choose any delay period from two or three seconds to a maximum of one to three minutes by rotating the control ring pointer to the desired position. Additional side lighting can be obtained by turning on a cornering light.

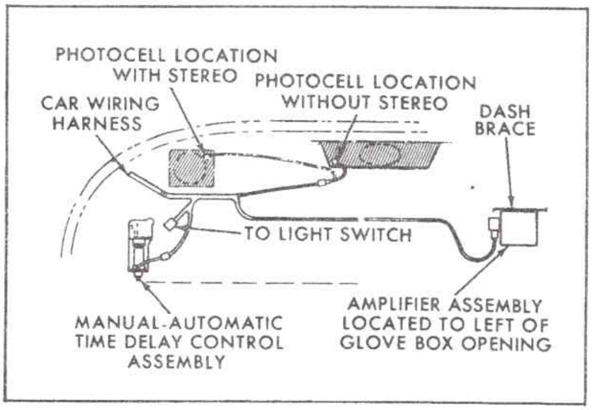


Fig. 15-38 Twilight Sentinel Components

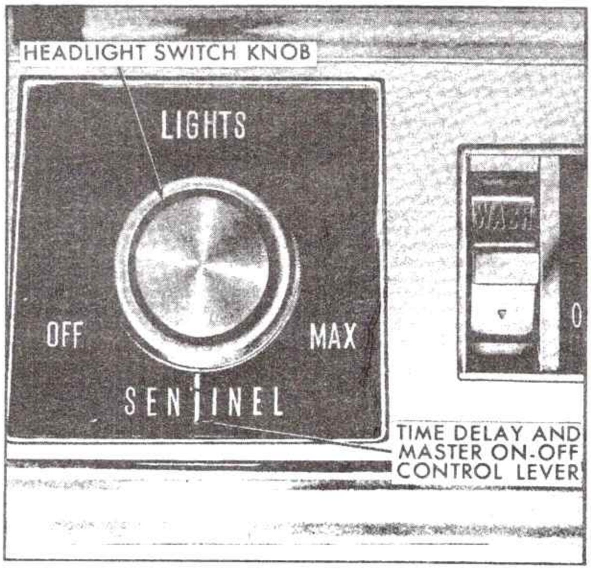


Fig. 15-39 Twilight Sentinel Control Lever

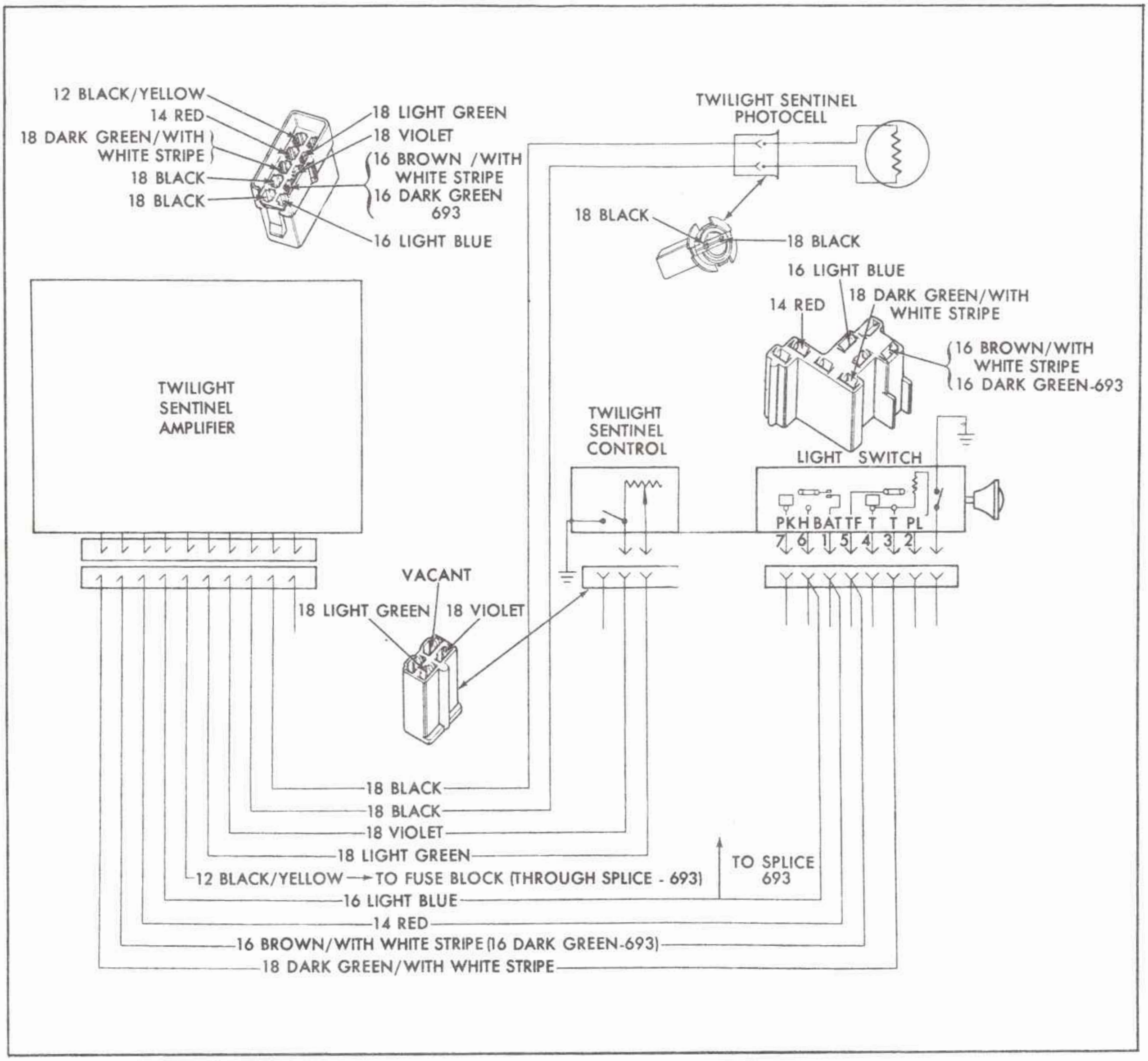


Fig. 15-40 Twilight Sentinel Circuit Diagram

Operation—Manual

If the driver desires to turn his car lights on during daylight hours, which may be necessary to identify the car in such conditions as fog, rain or when driving through a tunnel, he may do so by operating the regular light switch. This overrides the Twilight Sentinel, and the regular light switch must be turned off before the Twilight Sentinel can regain control.

To obtain manual operation of the car lights, place time delay turn-off control pointer in OFF position (extreme clockwise position). Lights will now operate only by the regular light switch.

SERVICE INFORMATION

37. Preliminary Checks

If trouble is reported, the condition will generally be one of the following:

1. Lights turn on too early or too late in the evening.
2. Lights remain on during daytime driving.
3. Lights fail to turn on automatically.
4. No turn-off time delay.
5. Excessive turn-off time delay or lights fail to turn off after ignition is turned off.

The following checks should be performed in sequence during diagnosis to determine the cause and correction and to eliminate unnecessary service work.

1. Check time delay control ring pointer for possibility of being rotated to "off position."

2. Make sure owner is not covering photocell opening with some object such as notebook, cigarette package, hat, etc.

3. The revised time delay circuit for reducing possibility of lights turning on or off when passing under various objects may confuse owners at first. If photocell is suddenly exposed to light or darkness, the time delay must run out (15 to 60 seconds) before amplifier can switch.

4. Make sure owner is operating unit with regular light switch turned off.

5. Check taillight fuse for possible burnout.

If steps 1 through 5 do not isolate problem, proceed to step 6. If checks 1 through 3 indicate owner misunderstanding, proper operation should be explained to him.

6. Place black cloth over photocell opening in radio speaker grille. (Remember, if car has stereo radio, the photocell is under small speaker grille on left end of upper instrument panel cover. If car is not equipped with stereo, photocell is under left side of regular front speaker grille.)

7. Turn regular headlight switch OFF. Rotate time delay control ring pointer to ON position so that pointer is approximately straight down.

8. Turn ignition on. Do not start engine. Car lights should turn on within from a few seconds to a maximum of 60 seconds, depending on how much time delay has run out since the photocell was covered. If they do, proceed to step 9. If lights fail to turn on, perform the following checks:

a. Check for blown taillight fuse at fuse panel if headlights turn on but taillights fail to turn on.

b. Turn regular light switch on. If headlights fail to turn on, car wiring is defective. If headlights turn on, check for defective wiring or connections between amplifier and light switch. Turn regular light switch off.

c. Check for loose ground connection or loose wiring harness connection at amplifier unit. Connect jumper wire between body ground and purple wire in amplifier 10-way connector. If lights turn on, check ground path through manual-automatic switch section of turn-off time delay control.

d. Disconnect either black wire (amplifier to photocell) from amplifier 10-way connector. If lights turn on, photocell unit is shorted and must be replaced.

e. If car lights still fail to turn on after performing steps "a" through "d", amplifier is defective and must be replaced.

9. Remove black cloth from photocell opening. Shine bright light (flashlight) in photocell opening in speaker grille. Car lights should turn off within 15 to 60 seconds (depending on the time delay run out). If they do, proceed to step 10. If not, perform the following checks:

a. Check for open wire connections between amplifier and photocell. (Black and gray wires on amplifier side of 10-way connector or two black wires on car wiring side of 10-way connector.)

b. Connect jumper wire between black and gray amplifier to photocell wires in 10-way connector on side of amplifier. If car lights turn off within a few seconds, photocell is disconnected, not mounted properly, or defective. If lights remain on, amplifier is defective and must be replaced.

c. To service photocell, remove upper instrument panel cover as described in Section 12, Note 37a, and check for loose connection where photocell plugs into socket, or photocell not properly mounted. If photocell is connected and secure, then photocell is defective and must be replaced. Install upper instrument panel cover as described in Section 12, Note 37b.

10. Cover photocell opening with black cloth and rotate time delay control ring pointer to maximum time delay position (extreme counterclockwise). Now wait until time delay runs out and headlights turn on. After headlights turn on, turn ignition off. Car lights should remain on for one to three minutes. If lights fail to operate as described above, perform the following checks as required:

a. NO TIME DELAY OR INSUFFICIENT TIME DELAY -- Check for shorted wiring and defective time delay control potentiometer. If no defects are indicated, amplifier is defective and must be replaced.

b. EXCESSIVE TIME DELAY AFTER IGNITION TURN OFF -- Check for open wire connection or open time delay control. If all right, the amplifier is defective and must be replaced.

11. If Twilight Sentinel responded to all of the above tests, the unit is functioning normally. If owner indicates dissatisfaction with turn on time, perform Minor Sensitivity Adjustment.

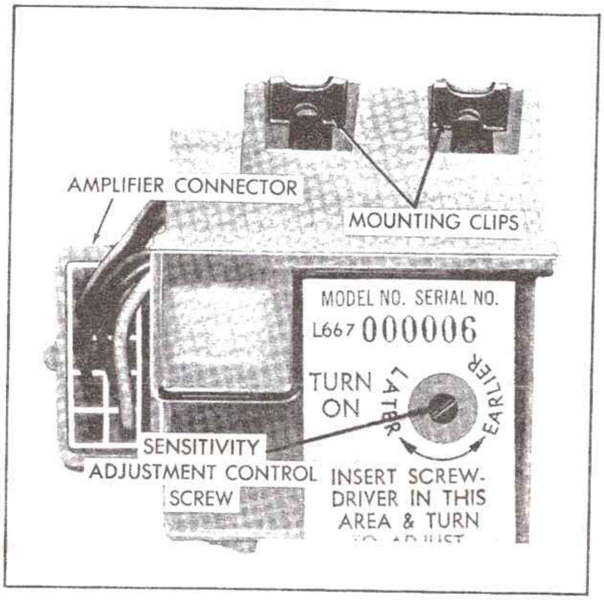


Fig. 15-41 Sensitivity Adjustment Control Screw

38. Minor Sensitivity Adjustment

As shown in Fig. 15-41, the sensitivity adjustment control is available through the serial sticker on the end of the amplifier. Puncture the serial sticker in the control area as shown. This end of the amplifier should be accessible under the lower edge of the instrument panel.

1. Using a small screwdriver, rotate sensitivity adjustment control, Fig. 15-41, one or two lines (marked around access hole) in the direction to correct owner complaint. Rotate control clockwise for later turn on or counterclockwise for an earlier turn on.

CAUTION: Do not rotate sensitivity control more than one or two lines (Marked around access hole) in either direction.

39. Control Switch

The procedure for removing and installing the Twilight Sentinel control switch is described in Section 12, Note 46.

40. Photocell Unit

The procedure for removing and installing the Twilight Sentinel photocell unit is described in Section 12, Note 66.

41. Amplifier Unit

The procedure for removing and installing the Twilight Sentinel amplifier unit is described in Section 12, Note 67.

TWILIGHT SENTINEL TROUBLE DIAGNOSIS

- Lights Turn On Too Early or Too Late in Evening
  - Perform Minor Sensitivity Adjustment as Described in Note 38.

- Lights Remain on During Daytime Driving
  - Make Sure Owner is Operating Unit with Regular Light Switch Turned Off.
    - Regular Light Switch Turned On. Explain Operation of System.
    - Regular Light Switch Turned Off
      - Make Sure Owner is not Covering Photocell with some Object. Photocell Located in Left Front Speaker Grille on AM/FM Stereo Radio and Front Center Speaker Grille On All Other Cars.
        - Owner Covering Photocell Explain Operation of System.
        - Owner Not Covering Photocell
          - Perform Preliminary Checks as Described in Note 37.
            - Preliminary Checks Show System is OK.
              - Perform Minor Sensitivity Adjustment as Described in Note 38.

- Lights Fail to Turn on Automatically
  - Check Tail Light Fuse If Head Lights Turn On but Taillights Do Not.
    - Tail Light Fuse Burned Out. Replace Fuse.
    - Tail Light Fuse OK
      - Perform Preliminary Checks as Described in Note 37.

- No Turn Off Time Delay
  - Check Tail Light Fuse
    - Tail Light Fuse Burned Out. Replace Fuse.
    - Tail Light Fuse OK
      - Perform Preliminary Checks as Described in Note 37.

- Excessive Turn-Off Time Delay or Lights Fail to Turn Off After Ignition is Turned Off
  - Perform Preliminary Checks as Described in Note 37.

GENERAL DESCRIPTION

REAR WINDOW DE-FOGGER

The Rear Window De-Fogger is available as either a factory or dealer installed accessory on all 1967 Cadillacs, except convertibles and 697 and 698 styles. The De-Fogger will prevent mist and fog from forming on the rear window. Air from the passenger compartment is drawn through an inlet on the rear parcel shelf, and is then directed against the rear window through an outlet located on the shelf.

The switch for controlling the Rear Window De-Fogger is located in the instrument panel cluster bezel. When the switch is in the center position, the de-fogger is OFF. Moving the switch to the right provides HIGH blower speed, and to the left LOW blower speed. The wiring diagram for the Rear Window De-Fogger is illustrated in Fig. 15-42.

42. Rear Window De-Fogger Checking Procedure

1. Perform blower motor test, Note 43.

2. If blower operates satisfactorily, perform blower switch test, Note 45.

3. Low and high speeds in the rear window De-Fogger are provided by a resistance type and ordinary wire in the wiring assembly, Fig. 15-42.

If blower motor and switch operate satisfactorily when tested, but the unit will not operate or will not give a variation between high and low speeds, the De-Fogger blower wire assembly is at fault. Repair or replace assembly if defective.

43. Blower Motor Test

1. If working on car, disconnect blower motor feed wire (yellow wire).

2. Using a 12-volt power source, connect the negative lead to blower motor housing and touch ground wire to housing if working off car. If working on car, make certain there is a secure ground wire to housing connection on all but 693 style. Connect the positive lead to the blower motor feed connection. If blower does not operate, replace as an assembly.

NOTE: If motor is operative but air is not fed from air outlet grille, check all hose connections and hoses for damage.

Check for obstructions at air inlet and outlet. The insulation between the cloth and metal package shelf should be slotted to provide air openings.

44. Rear Window De-Fogger Blower

a. Removal (All Except 693 Style)

NOTE: Access to blower motor is gained through trunk compartment.

1. Disconnect blower motor feed wire at blower motor.

2. Remove clamp securing hose to blower motor and remove hose.

3. Remove nut securing blower motor and ground wire to blower mounting screw and remove ground wire from screw.

4. Remove remaining three nuts securing blower motor to parcel shelf and remove blower motor.

b. Installation (All Except 693 Style)

1. Position blower motor with outlet pointing toward center of car. Use three star washer type nuts to secure to rear parcel shelf at all but the ground wire connection.

2. Position ground wire on remaining blower mounting screw and secure with plain nut.

3. Install hose at blower motor and secure with clamp.

4. Connect blower motor feed wire at blower motor.

c. Removal (693 Style)

NOTE: Access to blower motor is gained through trunk compartment.

1. Disconnect yellow blower motor feed wire at blower motor.

2. Remove two clamps securing hoses to blower motor.

3. Remove two screws securing blower motor and remove motor.

d. Installation (693 Style)

1. Position blower motor and secure with two screws.

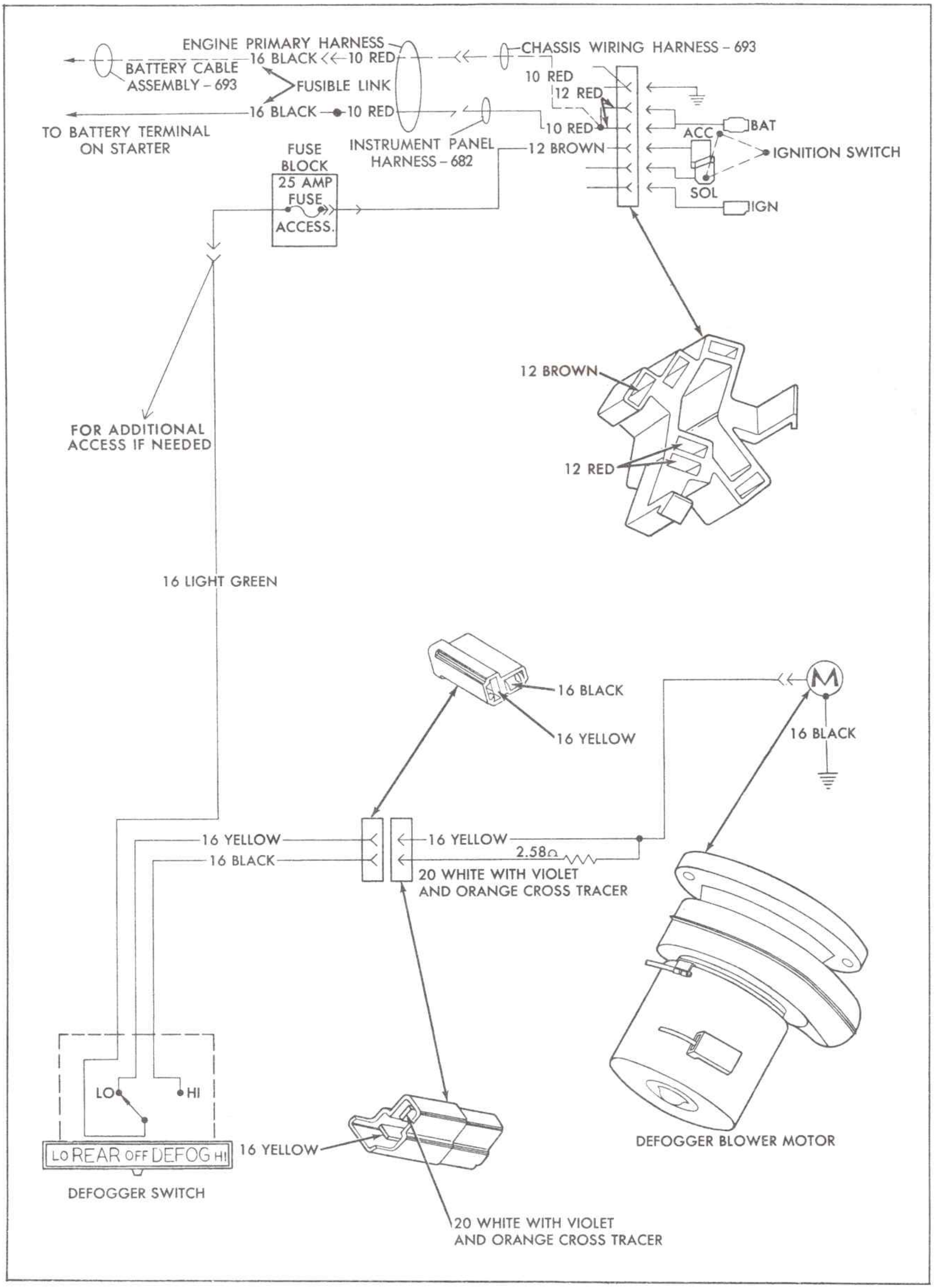


Fig. 15-42 Rear Window De-Fogger Circuit Diagram

2. Install two hoses at blower motor and secure with two clamps.

3. Connect yellow blower motor feed wire at blower motor.

45. Blower Switch Test

1. Remove steering column lower cover as described in Section 12, Note 38a, steps 2 - 6.

2. Turn ignition on but do not start engine. Disconnect accessories connector at fuse panel (light green wire). Touch one lead of a test lamp to ACC terminal on fuse panel and other to ground; lamp should light. If it does not, difficulty is in wiring to fuse panel or a blown fuse. If it does light, connect accessories connector at fuse panel and proceed as outlined below.

3. Check switch as follows:

a. Place switch lever in OFF position. Disconnect wiring connector leading from blower switch. Using connector with yellow and black leads, touch one lead of lamp at yellow wire terminal and ground other lead. Then touch one lead at black wire terminal and ground other lead. Lamp should not light in either instance.

b. Place switch lever in low speed position. Touch one lead at black wire terminal and ground other lead. Lamp should light. Then touch one lead at yellow wire terminal and ground other lead. Lamp should not light.

c. Place switch lever in high speed position. Touch one lead at black wire terminal and ground other lead. Lamp should not light. Then touch one lead at yellow wire terminal and ground other lead. Lamp should light.

If switch does not check as described above, replace as described in Section 12, Note 68.

46. Blower Switch Removal and Installation

The procedure for removing and installing the blower switch is described in Section 12, Note 68.

REAR WINDOW DE-FOGGER DIAGNOSIS CHART

CONDITION	CAUSE	REMEDY
De-fogger inoperative in any switch position.	Wiring to fuse block defective.	Locate defective wiring and correct.
	Blower motor defective.	Check as described in Note 43.
	Hose or hoses on 693 style damaged or disconnected.	Replace or connect.
	Defective blower switch.	Check as described in Note 45.
	Blower wire assembly open between splice and blower.	Repair or replace if other checks fail.
De-fogger inoperative in low speed position only.	Defective blower switch.	Check as described in Note 45.
	Defective white wire with violet and orange cross tracer.	Repair or replace if above check fails.
De-fogger inoperative in high speed position only.	Defective blower switch.	Check as described in Note 45.
	Yellow wire in de-fogger blower wire assembly defective before splice at white wire with violet and orange cross tracer.	Repair or replace if above check fails.
De-fogger operative with ignition ON and switch lever in OFF position.	Defective blower switch.	Check as described in Note 43.
De-fogger operates intermittently or varies in speed.	Loose ground wire connection at blower motor on all but 693 style.	Tighten connection.
	Frayed wiring.	Locate and repair or replace.
No air flow with motor and wiring performing correctly.	Obstruction at air inlet or outlet.	Remove obstruction check insulation between cloth and metal package shelf.

GENERAL DESCRIPTION

SEAT WARMERS

Seat Warmers are available as a factory-installed accessory on all 1967 Cadillac cars except the 698 style. The Seat Warmers are located in the front seats on all but 697 styles, which have Rear Seat Warmers.

Cloth heating pads with electrical resistance heating elements are located in the seat cushions and backs. The cloth material has a watt density of 25 watts per square foot, requiring an approximate 22-25 ampere current draw at 12 volts.

Seat Warmer

The system consists of an ON-OFF switch, thermal switch, relay, cloth heating pads, circuit breaker, fuse and wiring, Fig. 15-43. The ON-OFF switch is mounted on the instrument panel cluster bezel.

The relay is mounted on the right front wheel dustshield. The thermal switch is located in the heater water circuit between the water pump and heater core.

Wiring protection is provided by a 6-amp fuse near the tell-tale light terminal (#4) on the voltage regulator, and a 25 amp circuit breaker mounted with the relay on the right front wheel dustshield.

With the engine running and the ON-OFF switch on, the pads may be turned off with the ON-OFF switch; or, if left on, the system will turn off automatically when the heater water temperature opens the thermal switch. If the thermal switch is open (warm engine), the system will not turn

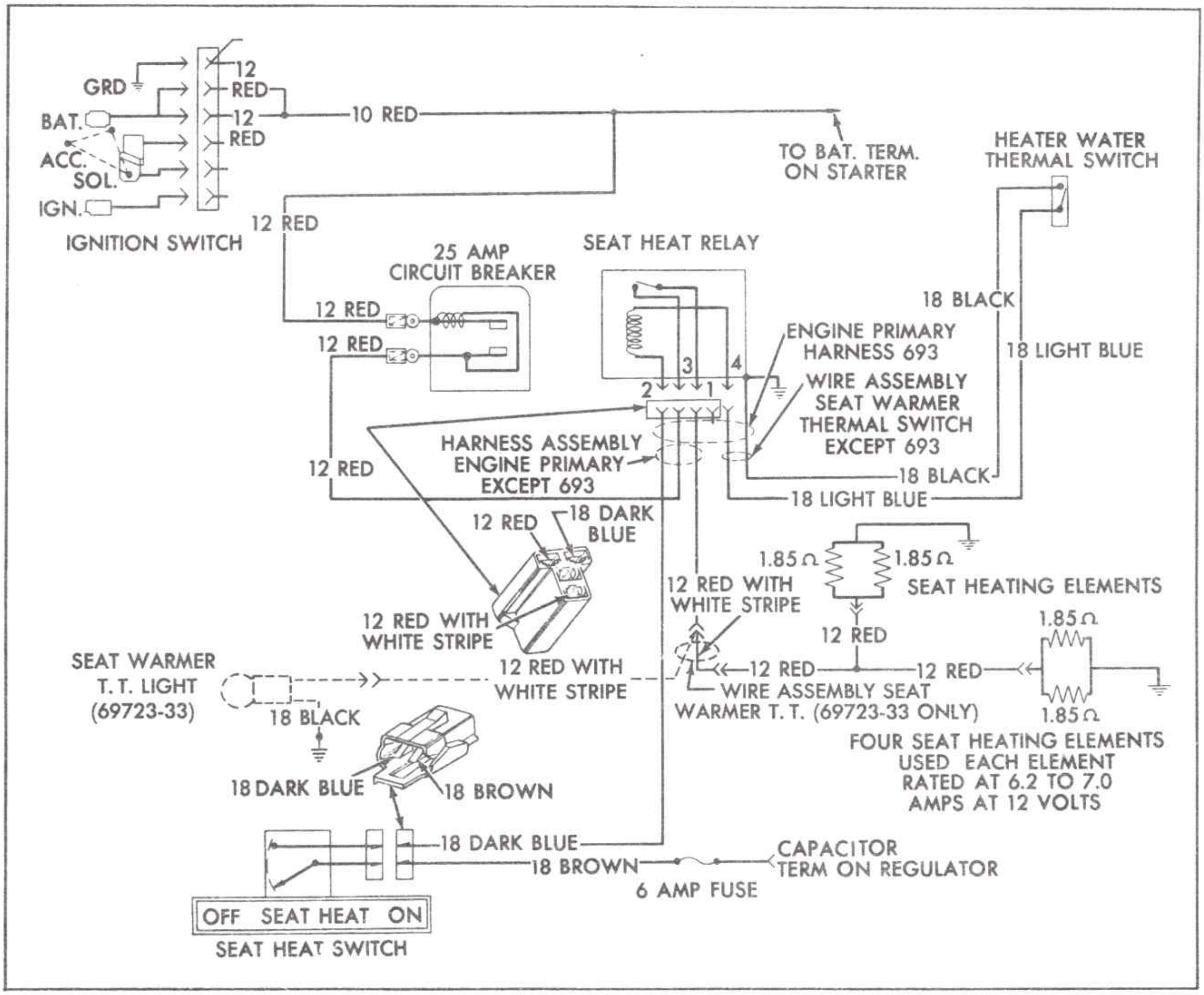


Fig. 15-43 Seat Warmer Circuit Diagram

on with the use of the ON-OFF switch. In addition, the system operates only with the engine running. On rear Seat Warmers, a red indicator lamp, located on the steering column lower cover, will glow when the pads are warming.

Seat Warmer Operation

With the engine running and the ON-OFF switch on, control current flows from the tell-tale light terminal (#4) of the voltage regulator, through the 6-amp fuse and the ON-OFF switch, and on to the relay coil in the relay through the thermal switch and to ground.

Current flows through the thermal switch only when the heater water temperature is less than approximately 150°F. Above this temperature, the thermal switch opens and no current flows.

The design of the control circuit is such that insufficient voltage is supplied for the relay coil to close the relay points except when the engine is running.

When the magnetic field in the relay coil closes the points, current flows from the battery terminal of the starter solenoid through the 25-amp circuit breaker, the relay points, and on to the seat pads.

47. Seat Warmer Component Testing

a. Quick Check

1. With engine off, use a self-powered test lamp to check continuity of black wire at thermal switch connector tee to ground at relay.

2. Detach connector at thermal switch (light blue wire) and attach a jumper wire from thermal switch connector to ground, Fig. 15-44.

   NOTE: A jumper wire with a male terminal on one end and an alligator clip on the other is best suited for this purpose.

3. Start engine and turn ON-OFF switch on.

4. After waiting one minute, all four heating pads should warm. On 697 styles, the red indicator lamp should glow.

5. Turn ON-OFF switch off and wait one minute. Pads should now be cooler.

6. If system operates as described above, the thermal switch should be tested as outlined in part (c) of this Note. If system passes quick check and thermal switch test, it is performing properly. If system does not pass quick check, more extensive tests are outlined in part (b) of this note. On 697 styles, if system operates properly except indicator lamp does not glow, refer to part d of this note.

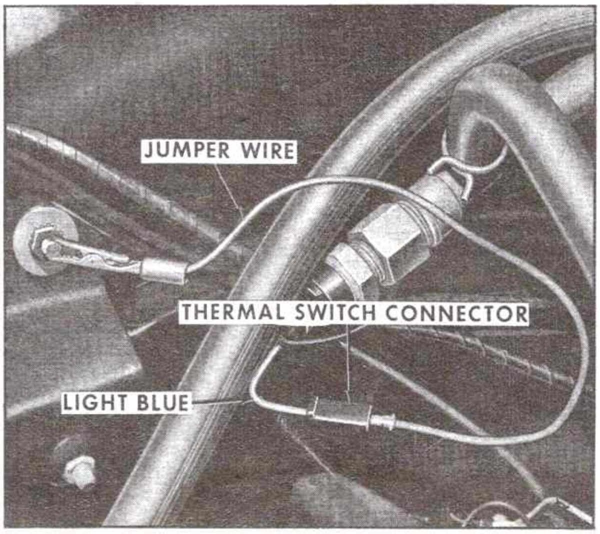


Fig. 15-44 Grounding Thermal Switch Connector

b. Seat Warmer Tests

NOTE: When performing these tests use a test lamp that is not self-powered except where the need of a self-powered test lamp is indicated.

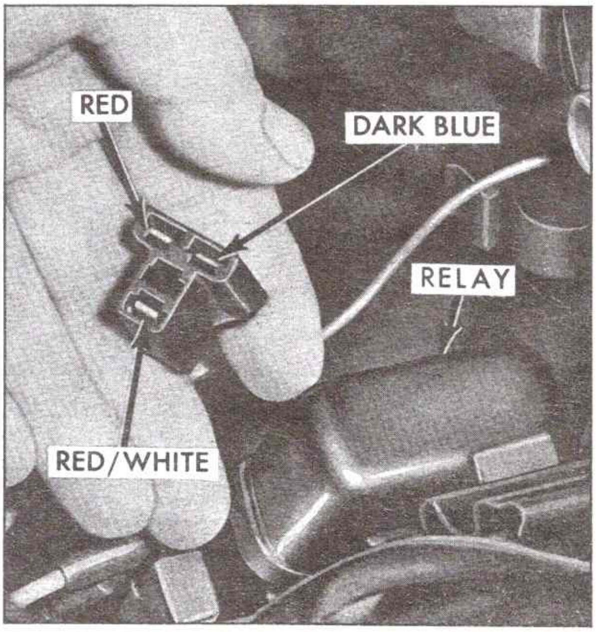


Fig. 15-45 Relay Multiple Connector

1. With engine off, use a self-powered test lamp such as Diode Tester, J-21008, to check continuity of black wire at thermal switch connector tee to ground at relay.

2. If proceeding from part (a) of this Note, disconnect jumper wire from thermal switch connector at ground. If not, detach connector at thermal switch (light blue wire) and attach a jumper wire at thermal switch connector.

NOTE: A jumper wire with a male terminal on one end and an alligator clip on the other is best suited for these tests.

3. Start engine and turn ON-OFF switch on.

4. Touch ground end of jumper wire to a good ground. Relay should click. If it does, proceed to step 10. If not, proceed to step 5. Attach jumper wire to ground, Fig. 15-44.

5. Detach multiple connector from relay. Touch one lead of test lamp to connector terminal attached to dark blue wire, Fig. 15-45, and ground other lead. Lamp should light. If lamp lights but relay did not click in step 4, the relay or light blue wire to the thermal switch is defective and must be replaced. If lamp does not light, proceed to step 6.

6. Remove steering column lower cover as described in Section 12, Note 38a, steps 2 - 6.

7. Disconnect ON-OFF switch connector. Touch one lead of a test lamp to connector terminal that has a brown wire leading to the voltage regulator and ground other lead. Lamp should light. If lamp lights, but did not light in step 5, ON-OFF switch or dark blue wire to relay is defective and must be replaced. If lamp does not light, proceed to step 8. Attach ON-OFF switch connector and make certain switch is in ON position.

8. Check for blown in-line 6-amp fuse in brown wire near voltage regulator terminal #4.

9. If circuit problem is still not isolated, perform further continuity checks in the remainder of the circuit to the positive battery terminal.

10. Touch one lead of test lamp to relay connector terminal attached to red wire, Fig. 15-45, and ground other lead. Lamp should light. If it does not, proceed to step 11.

11. If lamp did not light in step 10, remove protective cover from relay battery terminal. Mark terminal for installation purposes. Ground one lead of test lamp and touch other lead in turn to both circuit breaker mounting studs. If lamp lights at both terminals, red wire from circuit breaker to relay is defective; if lamp lights at one terminal but does not light at other, circuit breaker is defective; if lamp fails to light at either terminal, check red wire from circuit breaker to battery terminal of starter solenoid. Replace defective parts.

12. Turn ON-OFF switch off.

13. Disconnect straps and four wiring harness connectors beneath seat cushion.

14. Ground one lead of test lamp and touch other lead in turn to connector terminals that lead to relay. Lamp should not light. If it does, points in relay are stuck and relay must be replaced.

15. Turn ON-OFF switch on and repeat step 14. Lamp should light. If test lamp does not light at all terminals, wiring to relay or relay is defective and must be replaced. Also check harness connections at remaining two connectors beneath seat and at cowl. If one terminal connection makes the test lamp light, the defective wires must be repaired or replaced.

16. Using an ohmmeter, touch one lead in turn to each connector terminal that leads to heating pads and ground other lead. Ohmmeter should read approximately 1.85 ohms resistance at each connector. A very high reading indicates excessive resistance and a reading below one ohm indicates a short circuit. If one or more pads are defective, they must be replaced as described in Note 48.

17. If system operates as described above, the thermal switch should be tested as outlined in part c of this note.

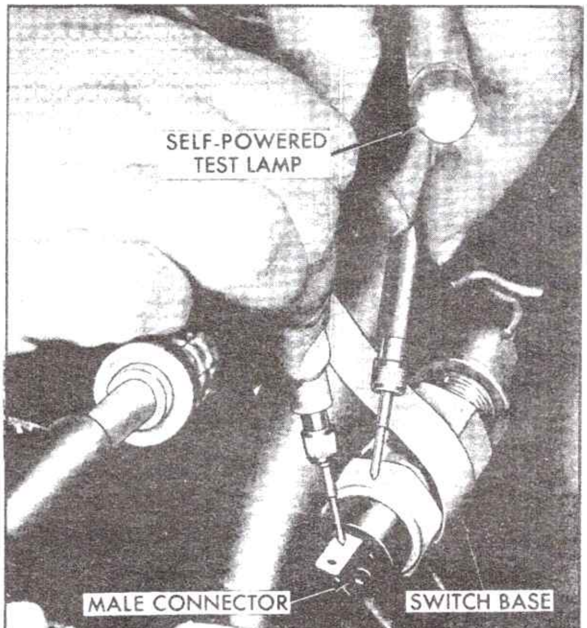


Fig. 15-46 Testing Thermal Switch

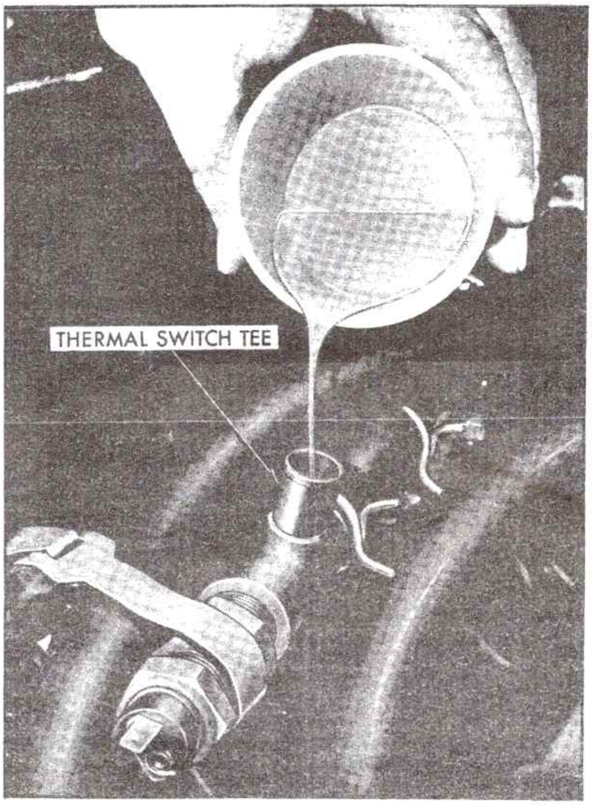


Fig. 15-47 Cooling Thermal Switch

c. Thermal Switch Test

1. Start engine and let it idle for five minutes. Turn off ignition.

2. Disconnect light blue wire at thermal switch (if not previously disconnected). Touch one lead of a self-powered test lamp to male connector and the other to base of switch, Fig. 15-46. Lamp should not light. If it does, replace switch.

3. Drain enough coolant from system to prevent coolant loss when top hose is removed. Remove top hose to thermal switch tee clamp and disconnect this hose. Pour a cup of cold water over tee, Fig. 15-47. Again touch one lead of self-powered test lamp to male connector and other to base of switch. Lamp should light. If lamp does not light, replace switch.

d. Indicator Lamp Service (697 Styles)

1. If red indicator lamp does not function on 697 styles, remove steering column lower cover as described in Section 12, Note 38a, steps 2 - 6.

2. Check bulb and replace if necessary.

3. Check condition of 18 black ground wire and repair or replace if necessary.

4. Check condition of other bulb lead and red with white stripe wire that attaches to this lead. Repair or replace if necessary.

5. Install steering column lower cover as described in Section 12, Note 38b steps 1 - 4. Check system as described in part a of this note.

48. Heating Pad

a. Removal

1. Disconnect four feed connectors to heating pads.

2. Remove seat trim cover and wiring. Heating pad is sewn into cover and is replaced with the trim cover.

b. Installation

1. Install wiring and new seat trim cover and sew into position.

2. Attach four feed connectors to heating pads.

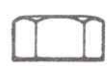
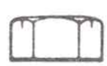
After any tests or work have been performed on the system, normal connections should be made and the Quick Check described in Note 47a should be performed again. If trouble was in the thermal switch, the Thermal Switch Test described in Note 47c should be repeated also.

BOLT AND NUT IDENTIFICATION

BOLT STEEL CLASSIFICATION

G. M. MATERIAL NO.	HEAD MARKING		STRENGTH
260-M		(None)	Standard
280-M		(120°)	Medium
300-M		(60°)	High

HEX-NUT STEEL CLASSIFICATION

G. M. MATERIAL NO.	MARKING			STRENGTH
Conventional Type				
286-M			(None)	Standard
301-M		 USUAL	(120°)	High
		 OPTIONAL	(120°)	
Prevailing Lock Type (Stover)				
A			(None)	Standard
B			(120°)	Medium
C			(60°)	High

WEIGHTS AND MEASURES

LINEAR MEASURE

1/12 foot (ft.)	=1 inch (in.)
12 inches	=1 foot
3 feet	=1 yard (1 yd.)

AREA MEASURE

1/144 square foot (sq. ft.)	=1 square inch (sq. in.)
144 square inches	=1 square foot
9 square feet	=1 square yard (sq. yd.)

LIQUID MEASURE

1/16 pint (pt.)	=1 ounce (oz.)
1 pint	=16 ounces
2 pints	=1 quart (qt.) = 32 ounces
4 quarts	=1 gallon (gal.)
31 1/2 gallons	=1 barrel (bbl.)

DRY MEASURE

1/2 quart (qt.)	=1 pint (pt.)
2 pints	=1 quart (qt.)
8 quarts	=1 peck (pk.)
4 pecks	=1 bushel (bu.)
105 quarts	=1 barrel

CUBIC MEASURE

1,728 cubic inches	=1 cubic foot
27 cubic feet	=1 cubic yard

COMMON WEIGHT

16 ounces	=1 pound
100 pounds	=1 hundred weight (cwt.)
2000 pounds	=1 ton

COMMON U.S.A. EQUIVALENTS

LENGTH

1 inch	=25.4001 millimeters
1 millimeter	=0.03937 inches
1 foot	=0.304801 meters
1 meter	=3.28083 feet
1 yard	=0.914402 meters
1 meter	=1.093611 yards
1 mile	=1.609347 kilometers
1 kilometer	=0.621370 miles

LIQUID CAPACITY

1 quart	=0.94633 liters
1 liter	=1.05671 quarts
1 gallon	=3.78533 liters
1 liter	=0.26418 gallons

DRY CAPACITY

1 quart	=1.1012 liters
1 liter	=0.9081 quarts
1 peck	=8.810 liters
1 liter	=0.11351 pecks

DRILL SIZES

Letter Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches
Z	0.413	1	0.2280	28	0.1405	55	0.0520
Y	0.404	2	0.2210	29	0.1360	56	0.0465
X	0.397	3	0.2130	30	0.1285	57	0.0430
W	0.386	4	0.2090	31	0.1200	58	0.0420
V	0.377	5	0.2055	32	0.1160	59	0.0410
U	0.368	6	0.2040	33	0.1130	60	0.0400
T	0.358	7	0.2010	34	0.1110	61	0.0390
S	0.348	8	0.1990	35	0.1100	62	0.0380
R	0.339	9	0.1960	36	0.1065	63	0.0370
Q	0.332	10	0.1935	37	0.1040	64	0.0360
P	0.323	11	0.1910	38	0.1015	65	0.0350
O	0.316	12	0.1890	39	0.0995	66	0.0330
N	0.302	13	0.1850	40	0.0980	67	0.0320
M	0.295	14	0.1820	41	0.0960	68	0.0310
L	0.290	15	0.1800	42	0.0935	69	0.0292
K	0.281	16	0.1770	43	0.0890	70	0.0280
J	0.277	17	0.1730	44	0.0860	71	0.0260
I	0.272	18	0.1695	45	0.0820	72	0.0250
H	0.266	19	0.1660	46	0.0810	73	0.0240
G	0.261	20	0.1610	47	0.0785	74	0.0225
F	0.257	21	0.1590	48	0.0760	75	0.0210
E	0.250	22	0.1570	49	0.0730	76	0.0200
D	0.246	23	0.1540	50	0.0700	77	0.0180
C	0.242	24	0.1520	51	0.0670	78	0.0160
B	0.238	25	0.1495	52	0.0635	79	0.0145
A	0.234	26	0.1470	53	0.0595	80	0.0135
		27	0.1440	54	0.0550		

DECIMAL EQUIVALENTS

1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.046875	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	.125	5/8	.625
9/64	.140625	41/64	.640625
5/32	.15625	21/32	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
1/4	.25	3/4	.75
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	.375	7/8	.875
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	.5	1	

B

D

G

H

T

U

V